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2014 - Public Update for Drought Response, Groundwater Basins, with Potential Water Shortages and Gaps in Monitoring

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY **EDMUND G. BROWN JR.**, *Governor*

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April 30, 2014

Report to the Governor's Drought Task Force – Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring

The Department of Water Resources (DWR) prepared the attached groundwater report as required by Governor's January 17, 2014 Emergency Drought Proclamation (Order Action Number 11). The proclamation required that DWR describe basins with potential water shortages and gaps in groundwater monitoring. Preparing the report entailed compiling and evaluating all available data, including information presented in California Water Plan Update 2013.

A follow-up groundwater report will be provided by November 30, 2014, as required by Governor's April 25, 2014 Executive Order (Order Action Number 11) that addresses areas where the drought has significant impacts to groundwater resources. DWR will conduct intensive outreach, provide technical assistance to local agencies in order to increase groundwater monitoring, and collect and analyze groundwater data. The focus of this report will be to identify groundwater basins with water shortages, gaps in groundwater monitoring, and provide the latest information on land subsidence and agricultural land fallowing.

Groundwater is a key priority for the Governor. The January 2014 California Water Action Plan developed by the Natural Resources Agency, California Environmental Protection Agency, and Department of Food and Agriculture identifies the critical need to improve groundwater management in the State. The Governor's 2014-15 budget proposes $618.7 million for funding actions in the Water Action Plan, including measures for drought response and to support improved groundwater management. The Water Action Plan expresses the Governor's commitment to work with local governments and agencies, Native American tribes, and the Legislature to identify and provide additional tools, resources, guidance, and the authority local managers need to sustainably manage groundwater resources. Recognizing that the State should protect groundwater basins that are at risk of permanent damage when a local agency is unable or unwilling to do so, the Governor's proposed budget provides resources to the State Water Resources Control Board to act as a backstop until an adequate local groundwater management plan is put in place.

In the next few months, DWR will continue to collaborate with the Governor's Office and other State agencies to develop the framework for a statewide sustainable groundwater management program, and DWR will take a lead role in implementing the program to fulfill the Governor's vision.

William A. Croyle, PE
Drought Manager

Attachment - Public Update for Drought Response Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring, dated April 2014

State of California

The Resources Agency

Department of Water Resources

Public Update for Drought Response Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring

April 30, 2014

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Executive Summary

Year 2013 closed as the driest in recorded history for many areas of California. On January 17, 2014, Governor Brown signed a Proclamation of a State of Emergency in response to the drought. This Public Update addresses Order #11 of the Governor's Proclamation and provides information regarding groundwater basins with potential water shortages and gaps in groundwater monitoring.

Groundwater is a vital resource in California providing close to 60 percent of the state's water supply in a dry year. Drought conditions typically result in an increase of groundwater well activity and pumping to compensate for water supply shortages. Increased groundwater pumping can lead to adverse conditions including dry wells, subsidence, decreased water quality, saline intrusion, and stream depletion. Evaluation of available data produced the following:

- Groundwater levels have decreased in nearly all areas of the state since spring 2013, and more notably since spring 2010.
- Since spring 2008, groundwater levels have experienced all-time historical lows (for period of record) in most areas of the state and especially in the northern portion of the San Francisco Bay Hydrologic Region, the southern San Joaquin Valley, and also for the South Lahontan and South Coast hydrologic regions.
- In many areas of the San Joaquin Valley, recent groundwater levels are more than 100 feet below previous historical lows.
- The greatest concentration of recently deepened wells is in the fractured bedrock foothill areas of Nevada, Placer, and El Dorado counties.
- The Kaweah and Kings subbasins have the greatest numbers of deepened wells in an alluvial groundwater basin.
- Thirty-six alluvial groundwater basins that have a high degree of groundwater use and reliance may possess greater potential to incur water shortages as a result of drought. The basins exist in the North Coast, Central Coast, Sacramento River, Tulare Lake, and South Coast hydrologic regions.
- Of California's 515 alluvial groundwater basins, 169 are fully or partially monitored under the California Statewide Groundwater Elevation Monitoring (CASGEM) Program.
- Forty of the 126 High and Medium priority basins are not monitored under CASGEM. There are significant CASGEM groundwater monitoring data gaps in the Sacramento, San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions.
- Although there are 4,122 CASGEM wells and 39,429 Voluntary wells in the Water Data Library groundwater level database, gaps in groundwater monitoring persist.
- Several areas of the state lack a current groundwater management plan that addresses all related requirements of the California Water Code.

DWR is contracting with National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory for use of satellite-based radar data to measure subsidence in the Sacramento and San Joaquin valleys. NASA, the U.S. Geological Survey, and U.S. Department of Agriculture are developing an automated system for estimating fallowed agricultural acreage. For detailed information regarding groundwater and groundwater management in California, please visit DWR's Groundwater Information Center at www.water.ca.gov/groundwater. For more information regarding DWR's drought response efforts, please visit www.water.ca.gov/waterconditions.

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Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring

1.0 INTRODUCTION

Groundwater is a vital resource to residents, businesses, farms, and industries in California. It provides close to 40 percent of the state's water supply in an average year and as much as 45 percent in dry years. During extensive dry or drought years, groundwater can provide close to 60 percent of the water supply. Some communities are 100 percent reliant upon groundwater for municipal and agricultural purposes. Year 2013 closed as the driest year in recorded history for many areas of California. On January 17, 2014, in response to these drought conditions, Governor Brown signed a Proclamation of a State of Emergency (www.gov.ca.gov/news.php?id=18368).

2.0 PURPOSE

The purpose of this document is to address Order #11 of the Governor's Proclamation: *The Department of Water Resources will evaluate changing groundwater levels, land subsidence, and agricultural land fallowing as the drought persists and will provide a public update by April 30 that identifies groundwater basins with water shortages and details gaps in groundwater monitoring.*

Specifically, this Public Update (Update) provides information regarding groundwater basins with potential water shortages and addresses gaps in groundwater monitoring. The California Department of Water Resources (DWR) utilized available information from several sources to identify groundwater basins with potential water shortages and gaps in groundwater monitoring. Data were compiled and analyzed from the California Statewide Groundwater Elevation Monitoring (CASGEM) Program, the Water Data Library (WDL) groundwater level database, the draft Bulletin 160 *California Water Plan Update 2013*, and from well completion reports (driller's logs) submitted to DWR. The focus of this Update was to analyze the available data and identify areas with potential groundwater shortages and gaps in groundwater level monitoring; water quality concerns were not investigated or directly included in the analysis. Where feasible, the most recent and available data were considered. Since spring groundwater level measurements are typically collected in March and April, and most are subsequently uploaded to the WDL database via the CASGEM Online System by July, some spring 2014 data was not yet available to include in this Update. DWR utilized groundwater level data available as of April 15, 2014. In addition, the well completion report data are likely incomplete because there is a lag time for drillers to submit the required reports to DWR. This Update can also serve as an indicator that additional groundwater information is needed to adequately address groundwater issues in the state.

This Update responds to the specific requirement in Proclamation Order #11 to provide a report on groundwater basins and groundwater monitoring. The proclamation also directs DWR to evaluate land subsidence and agricultural land fallowing. DWR is currently working with federal agencies such as the

National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration in a separate process to carry out this work by utilizing advanced technologies for monitoring drought impacts. DWR is contracting with NASA Jet Propulsion Laboratory for use of satellite-based Interferometric Synthetic Aperture Radar (InSAR) data to measure relative changes in land surface elevation in portions of the Sacramento and San Joaquin valleys from 2007 through 2014; this analysis is expected to be completed by early summer 2015. A test area along the California Aqueduct will also be evaluated using aircraft-based InSAR data; this work is expected to be completed about December 2014. NASA, the U.S. Geological Survey, and U.S. Department of Agriculture, National Agricultural Statistics Service are developing an automated system for DWR that will estimate fallowed agricultural acreage during the growing season. The system will rely on crop census data and on indices of vegetation greenness measured by satellite sensors. Monthly estimates of fallowed acreage will be reported from spring through fall 2014; the initial estimate is expected to be available at the end of April 2014.

3.0 FINDINGS

Groundwater is the primary supply of water in several areas of the state. Groundwater levels in these areas are more susceptible to impacts from drought conditions due to reductions in natural recharge, managed recharge, and subsurface inflow. Such reduced conditions typically result in an increase of groundwater well activity and pumping to compensate for water supply shortages. Although there may be active groundwater management programs, many areas do not have controls in place to restrict or stop groundwater pumping. Groundwater pumping is expected to increase as drought conditions worsen. The increased pumping can lead to adverse conditions including dry wells, subsidence, decreased water quality, saline intrusion, and stream depletion. Figure 1 depicts areas of the state that have a high degree of groundwater use and reliance, have experienced significant lowering of groundwater levels since spring 2010, and have experienced groundwater levels at all-time historical lows (for period of record) since spring 2008.

Water shortages and potential shortages have been identified in areas of alluvial groundwater basins and in areas that derive groundwater from fractured bedrock (foothill and mountainous areas). Several alluvial groundwater basin areas are already known to experience groundwater shortages, while other basins possess indicators associated with potential water shortage. There are several areas of the state experiencing decreasing groundwater levels and deepening of water wells.

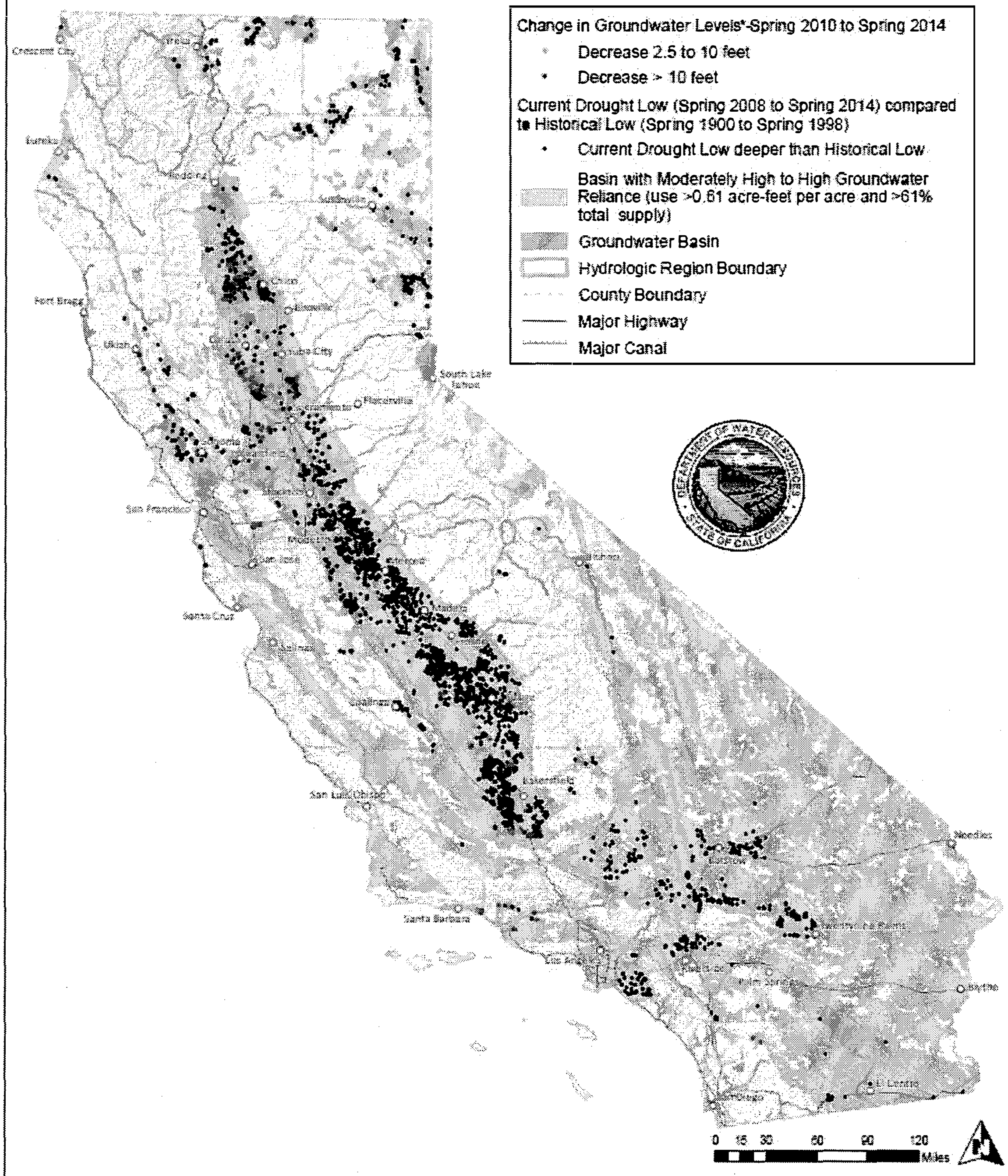
> Groundwater levels have decreased in nearly all areas of the state since spring 2013, and more notably since spring 2010. Since spring 2008, groundwater levels have experienced all-time historical lows in most areas of the state and especially in the northern portion of the San Francisco Bay Hydrologic Region, the southern San Joaquin Valley, and also for the South Lahontan and South Coast hydrologic regions – these areas exhibit groundwater levels more than 50 feet below previous historical lows experienced sometime prior to 2000. There are many areas of the San Joaquin Valley where recent groundwater levels are more than 100 feet below previous historical lows. The greatest concentration of recent well deepening activity is in the foothill areas of Nevada, Placer, and El Dorado counties. The Kaweah and Kings subbasins have the greatest numbers of deepened wells within the San Joaquin Valley. A total of 36 alluvial groundwater

basins have a high degree of groundwater use and reliance. As such, these basins may possess greater potential to incur water shortages as a result of drought. The basins exist in five hydrologic regions: North Coast (2), Central Coast (17), Sacramento River (5), Tulare Lake (1), and South Coast (11).

Monitoring groundwater levels is critical for assessing the status of a groundwater basin over time, and is particularly important during dry years and drought conditions. There are several areas within the state that appear to lack sufficient groundwater monitoring.

Only 169 of Califomia's 515 alluvial groundwater basins are fully or partially monitored under the CASGEM Program. Forty of the 126 High and Medium priority basins are not monitored under CASGEM. There are significant groundwater monitoring data gaps in the Sacramento, San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions. There are gaps on a statewide scale – basins that are not yet being monitored under the CASGEM Program, as well as gaps on the basin scale – basins with spatial data gaps. With respect to groundwater management plans, several areas of the state either lack a plan, or the existing plan has not been updated to address the requirements of the Califomia Water Code as of 2002 (SB 1938) or 2012 (AB 359). Such areas may also lack sufficient monitoring and/or management of groundwater and are potentially subject to increased stress or impacts due to drought conditions.

Figure 1 - 2014 Drought - Potential Groundwater Shortages



*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/15/2014. Document Name: 2014_Drought_Potential_Groundwater_Shortages Updated: 04/23/2014 Data subject to change without notice.

4.0 GROUNDWATER BASINS WITH POTENTIAL WATER SHORTAGES

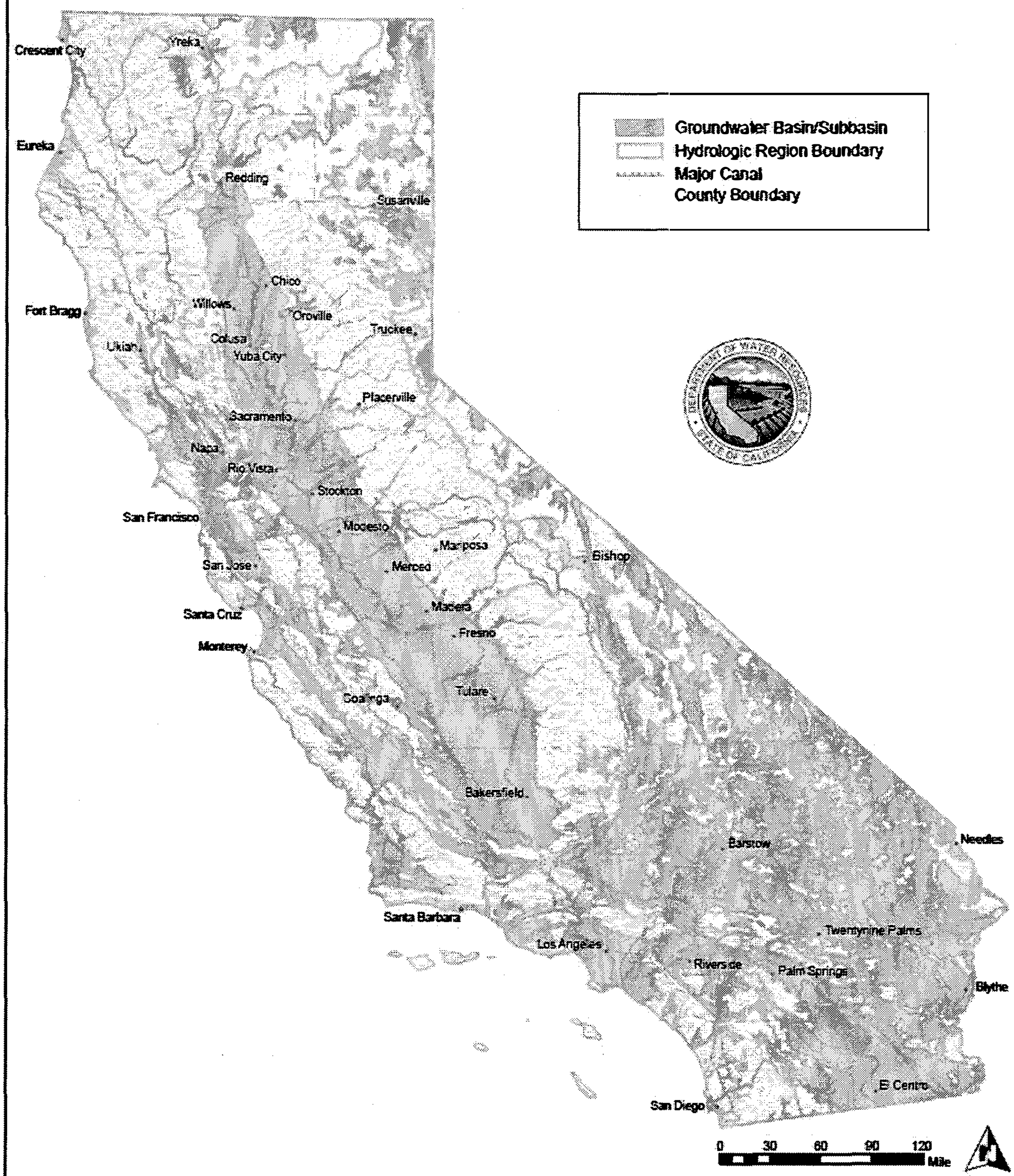
In California, most groundwater is found in basins filled with alluvial deposits. Figure 2 depicts 515 alluvial groundwater basins as defined in DWR's Bulletin 118 Update 2003 (Bulletin 118-03, www.water.ca.gov/groundwater/bulletin118/update2003). Close to 90 percent of the groundwater used in California is extracted from only about 126 of the 515 alluvial groundwater basins. Groundwater is also found in fractured bedrock in foothill and mountainous areas. However, the amount of groundwater found in fractured bedrock is relatively small compared with the amount found in alluvial basins. Nevertheless, fractured bedrock is the sole source of water supply for many communities in California, and for many individual residences.

Some communities rely solely on surface water, some rely solely on groundwater, and some rely on both surface water and groundwater to meet demands. The amount of groundwater use relative to the amount of surface water use varies greatly over the state. Figure 3 summarizes statewide contribution of groundwater compared to the total water use as reported in the draft *California Water Plan Update 2013* (www.waterplan.water.ca.gov/cwpu2013). Based on average annual data for years 2005 to 2010, groundwater use was near 16.5 million acre feet and accounted for about 39 percent of the total water supply in California.

The amount of groundwater use relative to surface water use also varies over time. In years of greater precipitation and runoff, more surface water is available to replenish groundwater basins and fractured bedrock; whereas, in dry years when less surface water is available, groundwater is relied upon to meet water demands. The practice of using surface water when available and relying more heavily on groundwater when surface water becomes scarce is known as conjunctive water use or conjunctive water management. Under conjunctive water management, during wet seasons or years, surface water replenishes groundwater basins and water levels in wells typically increase. During dry seasons or dry years, more groundwater is extracted and water levels in wells typically decline.

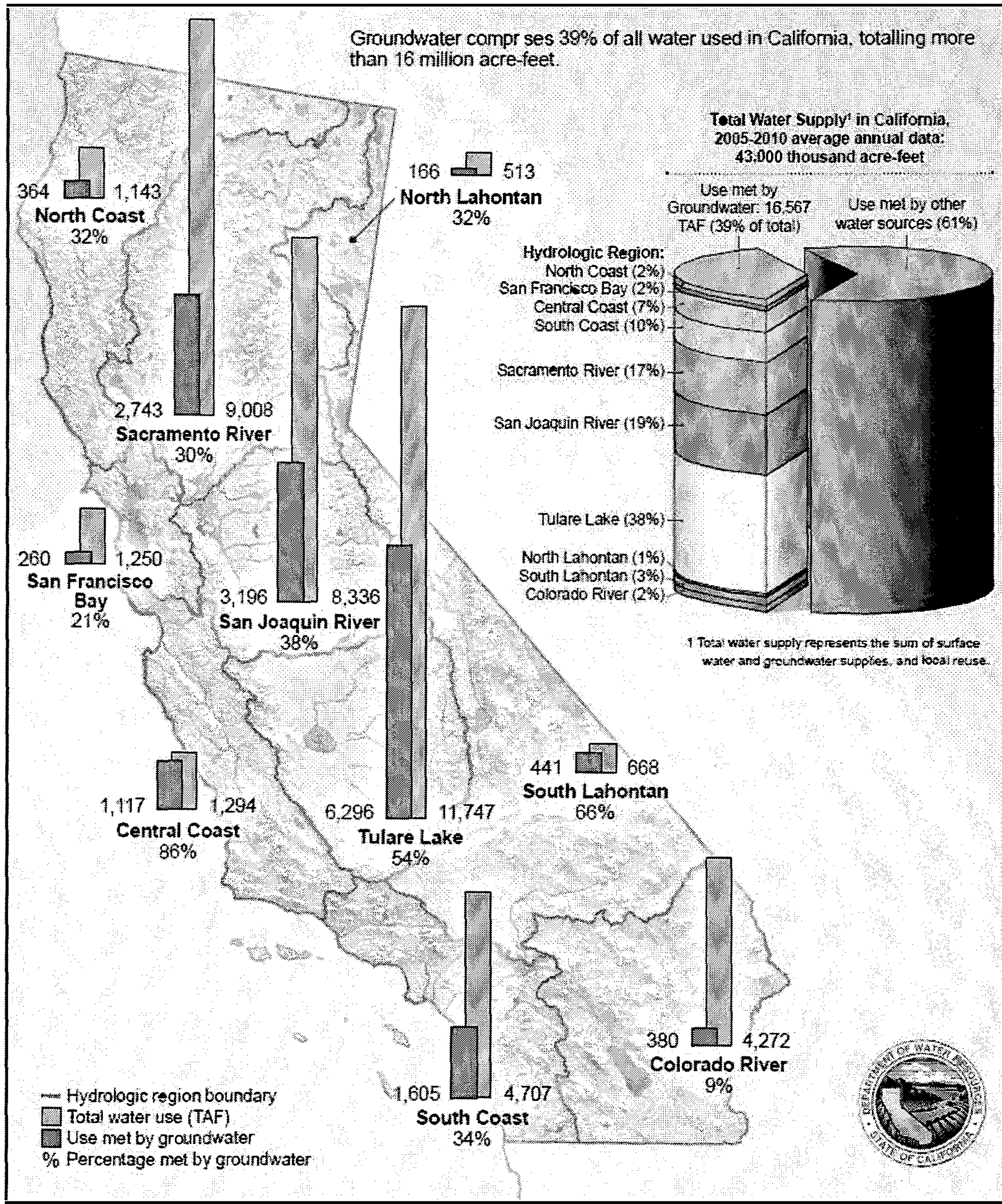
The decline of water levels in a groundwater basin may be a sign that water use is outpacing the short-term recharge of that groundwater basin. However, in dry years the basin may be managed such that groundwater is extracted, lowering water levels until more recharge is available in the next wet year. To be able to discern whether a groundwater basin may be in shortage, groundwater levels must be analyzed over a time period that includes dry and wet years. Some groundwater basins hold vast amounts of water with decades or centuries of water supply in the basin. Even for a basin that exhibits overdraft conditions, groundwater may not be in shortage. The activity of deepening water wells is an indicator that water levels have declined to a point where a well no longer supplies adequate water. Groundwater levels at historical lows may also be an indicator that water use in the current drought is causing a greater decline in water levels than in previous dry years or droughts.

Figure 2 - Bulletin 118-03 Alluvial Groundwater Basins



Map based on groundwater basin boundaries established in *Bulletin 118 Update 2003*, Department of Water Resources

Figure 3 - Contribution to California Water Supply by Hydrologic Region



Source: *Draft California Water Plan Update 2013*, Department of Water Resources

4.1 Groundwater Well Deepening Activity

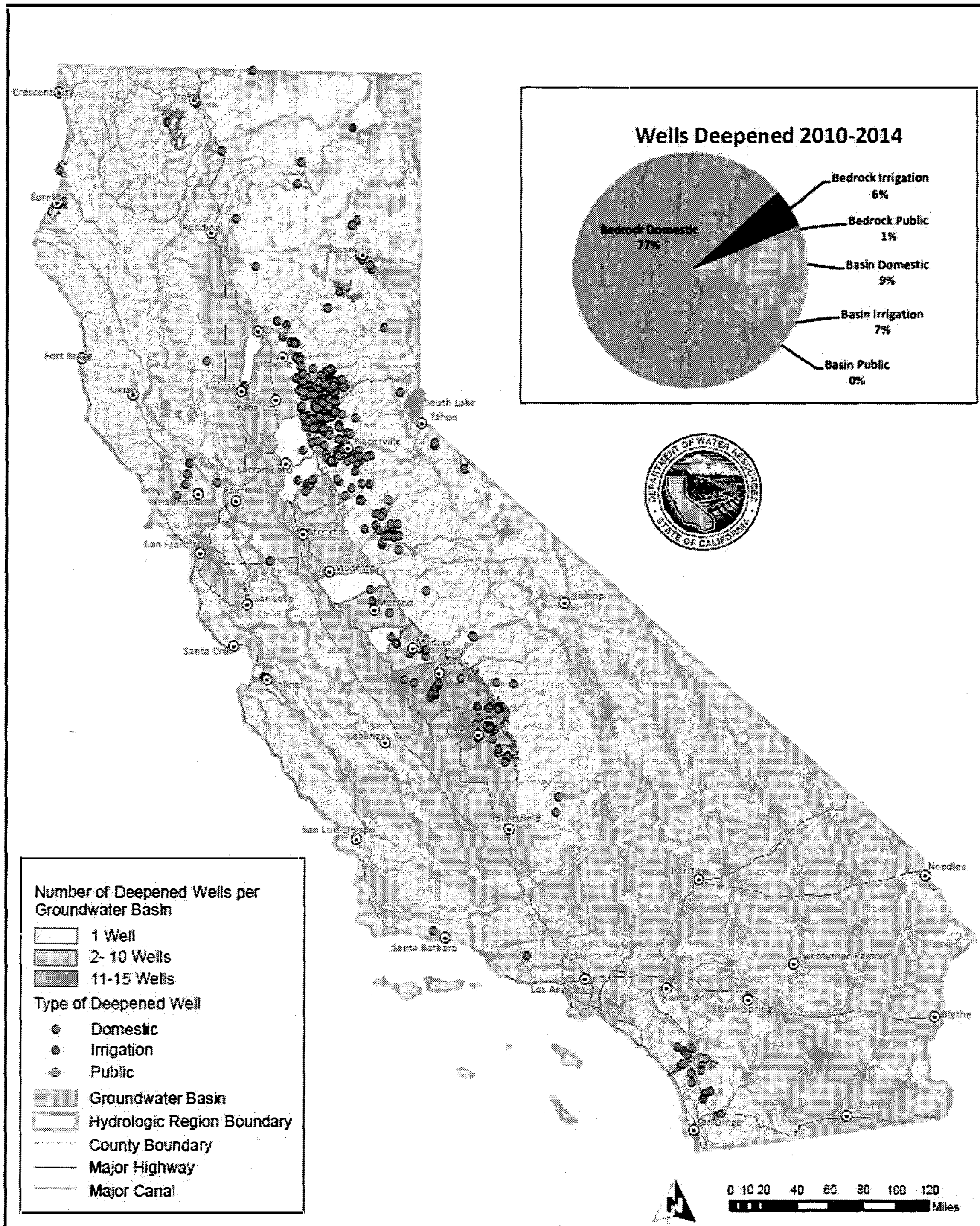
Groundwater levels typically decline during drought, and when groundwater levels decline below the level of the pump in a water well, the pump must be lowered. If groundwater levels decline to the point where the pump cannot be lowered, the yield is too small, or the well goes dry, a well owner may need to deepen the existing well or potentially drill a new well. Analysis of well completion reports (driller's logs) submitted by water well drillers can provide information about where the effects of drought may result in a water shortage.

New water wells are drilled during both wet and dry periods, including droughts. It is likely that wells are deepened primarily during dry periods when groundwater levels are declining, well yields are decreasing, or wells dry. As such, a correlation exists between the deepening of water wells and drought-related water shortages. However, there are limitations with the analysis as well completion reports do not discern if a new well is drilled to replace an existing well or if it is drilled to provide additional or new water supply.

DWR analyzed available well completion reports for water wells that were deepened from 2010 through early 2014. The analysis identified the location of each well and determined whether the well is in a defined groundwater basin or in an area of fractured bedrock. The analysis also determined whether the well is for domestic use, irrigation, or public water supply. Figure 4 depicts the locations of water wells that were deepened from 2010 through early 2014. Table 1 shows the totals for each type of water well that was deepened, by county, and whether the wells are in a groundwater basin or in an area of fractured bedrock. About 86 percent of the wells deepened are for domestic water supply, about 13 percent of the wells are for irrigation, and one (1) percent of the wells are for public water supply. About 16 percent of the wells deepened are in alluvial groundwater basins, whereas 84 percent of the wells deepened are in fractured bedrock areas. The greatest concentration of deepened wells is found in the foothill areas of Nevada, Placer, and El Dorado counties.

Table 2 shows the totals and types of water wells deepened in alluvial groundwater basins. The Kaweah and Kings subbasins have the greatest number of deepened wells. About 55 percent of the water wells deepened in groundwater basins are for domestic supply, about 43 percent of the wells are for irrigation, and two (2) percent (one well) are for public supply. The groundwater basins where water wells were deepened are highlighted on Figure 4.

Figure 4 - **Water Wells Deepened 2010-2014**



Data evaluated from well completion reports showing deepening received and processed by April 10, 2014. Well deepening is interpreted to indicate declining water supply in wells. Basins illustrated are interpreted to be more likely to have water shortages. Data may not be complete statewide. Data subject to change.

Table 1 - Counties with Wells Deepened from 2010 through early 2014

	Wells in Alluvial Groundwater Basins			Wells in Fractured Bedrock			Total
County	**Domestic**	**Irrigation**	**Public**	**Domestic**	**Irrigation**	**Public**	
Alameda				1			1
Alpine				3			3
Amador				6			6
Butte				12	2		14
Calaveras				11		2	13
Del Norte	1						1
El Dorado				41			41
Fresno	5	6		3	1		15
Humbolt	2						2
Kern				2			2
Lassen				8			8
Madera	4	2		1	2		9
Merced	2	1					3
Modoc		1		1			2
Mono	1						1
Monterey		1					1
Napa				2			2
Nevada				90			90
Placer	1			43			44
Plumas	1	1		1			3
Sacramento	4	1		1			6
San Diego			1	5	11		17
Santa Barbara				1			1
Shasta	1			1			2
Sierra				1			1
Siskiyou		1		3			4
Sonoma				2	1		3
Tulare	10	10		1	2		23
Tuolumne				17			17
Ventura		1					1
Yuba				16		1	17
Total	**32**	**25**	**1**	**273**	**19**	**3**	**353**

Findings of this analysis support a conclusion that water wells in areas of fractured bedrock are more vulnerable to water shortages than wells in groundwater basins. This conclusion is consistent with observations made during previous droughts in California (www.water.ca.gov/waterconditions). The findings of this analysis are based on available well completion reports submitted to DWR as of April 11, 2014 and those reports that were readily available for obtaining information on well deepening. There are likely additional records of deepened wells not included herein as well completion reports may be submitted up to 60 days after work is completed. Moreover, in some places, well owners may have decided to drill a new well rather than deepen an existing well. Consequently, the magnitude of possible shortages and the extent of the areas with possible water shortages may be greater than this analysis reflects.

Table 2 - Groundwater Basins with Wells Deepened from 2010 through early 2014

Hydrologic Region	Basin Number	Basin/Subbasin	Domestic	Irrigation	Public	Total
North Coast	1-5	Scott River Valley		1		1
	1-9	Eureka Plain	1			1
	1-27	Big Lagoon Area	1			1
Central Coast	3-4.01	Salinas Valley - 180/400 Foot Aquifer		1		1
Sacramento River	5-2	Alturas Area		1		1
	5-5	Fall River Valley	1			1
	5-9	Indian Valley		1		1
	5-21.58	Sacramento Valley - West Butte	1			1
	5-21.64	Sacramento Valley - North American	1			1
	5-21.65	Sacramento Valley - South American	1			1
	5-95	Meadow Valley	1			1
San Joaquin River	5-22.03	San Joaquin Valley - Turlock	1			1
	5-22.04	San Joaquin Valley - Merced	1	1		2
	5-22.05	San Joaquin Valley - Chowchilla		1		1
	5-22.06	San Joaquin Valley - Madera	4	1		5
	5-22.16	San Joaquin Valley - Cosumnes	3	1		4
Tulare Lake	5-22.08	San Joaquin Valley - Kings	5	7		12
	5-22.11	San Joaquin Valley - Kaweah	6	7		13
	5-22.13	San Joaquin Valley - Tule	4	2		6
North Lahontan	6-7	Antelope Valley	1			1
South Coast	4-15	Tierra Rejada		1		1
	9-7	San Luis Rey Valley			1	1
Total			**32**	**25**	**1**	**58**

4.2 Groundwater Reliance

California Water Code Section 10933 requires DWR to prioritize California's groundwater basins and subbasins (as identified in Bulletin 118-03). In January 2014, DWR released the draft CASGEM basin prioritization process and results for public review. The final basin prioritization process and results are expected to be completed by May 2014 (www.water.ca.gov/groundwater/casgem).

To identify groundwater basins with potential water shortages, DWR used the draft CASGEM basin prioritization results related to groundwater reliance. For the CASGEM basin prioritization process, analysis of groundwater reliance included consideration of the total annual volume of groundwater use, the annual volume of groundwater use per acre, and the percent to which groundwater contributes to the overall water supply for the basin.

Using the available CASGEM data, this analysis to identify potential groundwater shortages focused on 1) basins with high groundwater use (groundwater use greater than 0.61 acre-feet per acre), and 2) basins with a high groundwater reliance relative to overall supply (groundwater reliance greater than 61 percent). A total of 36 groundwater basins (Table 3) have a moderately high or a high degree of both groundwater use and groundwater reliance. As such, these basins may possess greater potential to incur water shortages as a result of drought. Figure 1 depicts the locations of these 36 basins. The basins exist in five hydrologic regions: North Coast (2), Central Coast (17), Sacramento River (5), Tulare Lake (1), and South Coast (11). These 36 basins account for a total of about 2.54 million acres of land and a population of approximately 6.18 million. Although the basins listed in Table 3 are heavily reliant on groundwater, some of the basins are less likely than others to experience water shortages because the basin is either adjudicated (Raymond, Chino, and San Gabriel Valley) or managed by a water district (Coastal Plain of Orange County) that actively monitors and controls groundwater extraction.

Table 3 - Groundwater Basins with High Groundwater Reliance

Basin Number	Basin	Subbasin	Hydrologic Region
1-3	Butte Valley		North Coast
1-10	Eel River Valley		North Coast
3-1	Soquel Valley		Central Coast
3-2	Pajaro Valley		Central Coast
3-4.01	Salinas Valley	180/400 Foot Aquifer	Central Coast
3-4.02	Salinas Valley	East Side Aquifer	Central Coast
3-4.04	Salinas Valley	Forebay Aquifer	Central Coast
3-4.05	Salinas Valley	Upper Valley Aquifer	Central Coast
3-4.09	Salinas Valley	Langley Area	Central Coast
3-7	Carmel Valley		Central Coast
3-8	Los Osos Valley		Central Coast
3-9	San Luis Obispo Valley		Central Coast
3-12	Santa Maria		Central Coast
3-37	Villa Valley		Central Coast
3-38	Cayucos Valley		Central Coast
3-39	Old Valley		Central Coast
3-40	Toro Valley		Central Coast
3-41	Morro Valley		Central Coast
3-42	Chorro Valley		Central Coast
4-13	San Gabriel Valley		South Coast
4-23	Raymond		South Coast
5-14	Scotts Valley		Sacramento River
5-15	Big Valley		Sacramento River
5-21.51	Sacramento Valley	Corning	Sacramento River
5-21.57	Sacramento Valley	Vina	Sacramento River
5-21.58	Sacramento Valley	West Butte	Sacramento River

Table 3 - Groundwater Basins with High Groundwater Reliance (Cont.)

Basin Number	Basin	Subbasin	Hydrologic Region
5-22.13	San Joaquin Valley	Tule	Tulare Lake
8-1	Coastal Plain of Orange County		South Coast
8-2.01	Upper Santa Ana Valley	Chino	South Coast
8-2.04	Upper Santa Ana Valley	Rialto-Colton	South Coast
8-2.05	Upper Santa Ana Valley	Cajon	South Coast
8-2.06	Upper Santa Ana Valley	Bunker Hill	South Coast
8-2.07	Upper Santa Ana Valley	Yucaipa	South Coast
8-7	Big Meadows Valley		South Coast
9-4	Santa Margarita Valley		South Coast
9-10	San Pasqual Valley		South Coast

Note: Groundwater Use >0.61 acre-feet per acre and Groundwater Supply >61 percent of Total Supply

4.3 Groundwater Levels

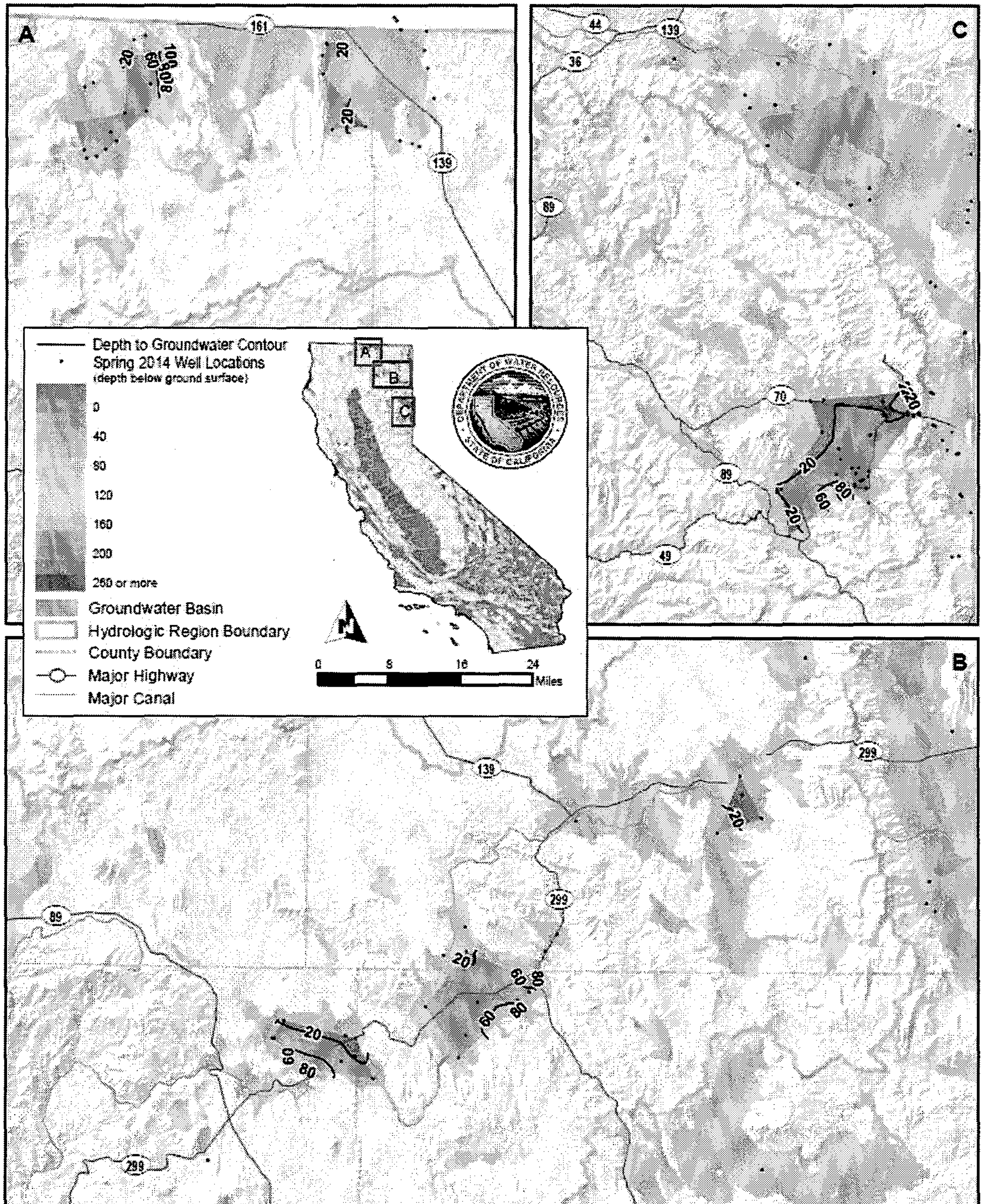
Groundwater level measurement data are often analyzed using maps and graphs to illustrate and evaluate current or past groundwater conditions, groundwater level trends, or changes in groundwater conditions between two monitoring periods. Preparation and review of groundwater level data provides important information about where groundwater shortages could exist, and where more data are needed. Areas with relatively low groundwater levels may be more vulnerable to groundwater shortages in dry years. Also, areas or regions with declining groundwater levels may be susceptible to groundwater shortages in the future.

The maps and figures developed for this Update rely on groundwater level measurements collected during the spring. In California, spring measurements typically depict the highest groundwater elevations for the year, at a time just prior to the irrigation season and after groundwater levels have had an opportunity to rebound from winter precipitation and snowmelt. Fall measurements typically reflect groundwater conditions after the irrigation season is over and prior to winter precipitation when groundwater levels in many basins are expected to be at or near their lowest levels for the year. The groundwater level maps prepared for this Update include available data as of April 15, 2014.

Depth to groundwater contour maps use lines of equal depth to depict where the top of the groundwater surface is relative to land surface. These maps are particularly useful when considering installation of dedicated groundwater monitoring wells or the design and operating costs of new production wells. Depth to groundwater information is also useful when compared to construction depths of existing domestic and production wells. The analysis of groundwater levels can help identify areas with wells that may be impacted by the continued decline of groundwater levels. Figures 5 through 8 depict spring 2014 depth to groundwater contours for selected basins in California. The areas selected were based on the density of available data and the ability to illustrate representative contours.

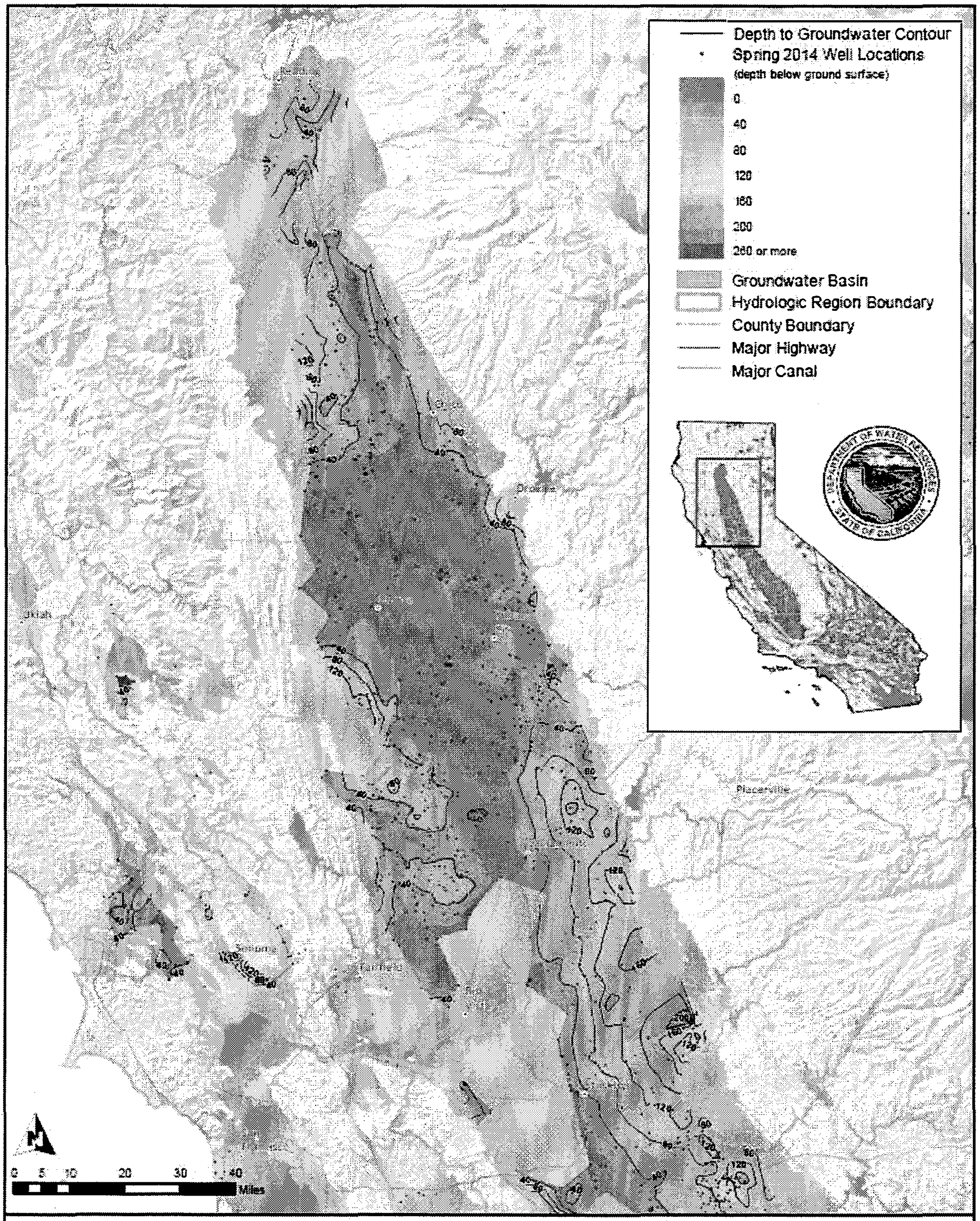
Groundwater level change maps depict the difference between groundwater levels over a specified time period. Plotting the difference between groundwater level measurements collected at different times and at discrete locations is a simple way to depict changes in groundwater levels and evaluate regional trends. Figures 9 and 10 depict change of groundwater levels at well locations from spring 2013 to spring 2014 and from spring 2010 to spring 2014, respectively. Based on the available data, groundwater levels have decreased in nearly all areas of the state since spring 2013, and more notably since spring 2010.

Figure 5 - Depth to Groundwater - Spring 2014
Selected Groundwater Basins in Northern California



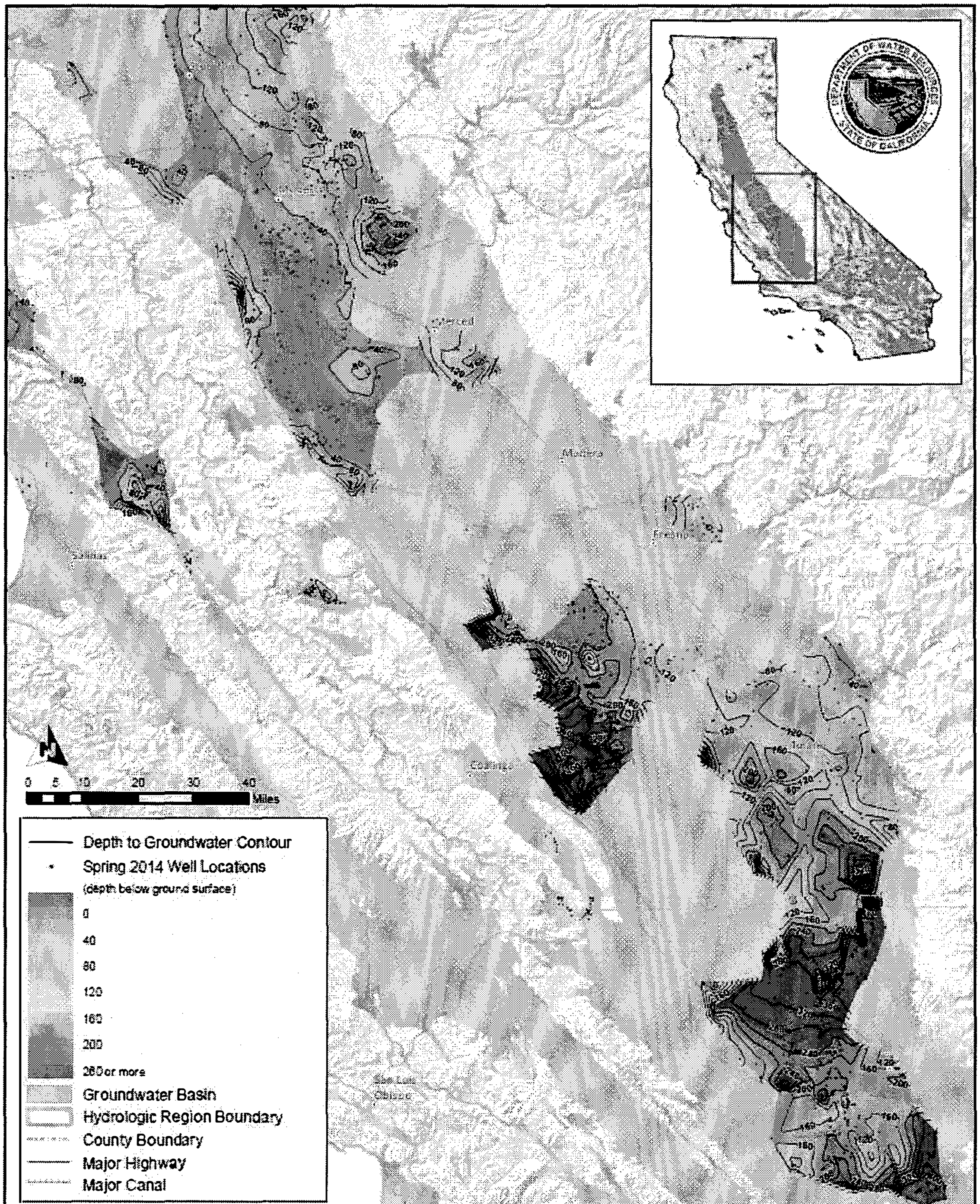
Depth to groundwater determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/15/2014. Document Name: S2014_DBGS_NorCal_20140422
Updated: 04/21/2014 Data subject to change without notice.

Figure 6 - Depth to Groundwater - Spring 2014
Selected Groundwater Basins in North Central California



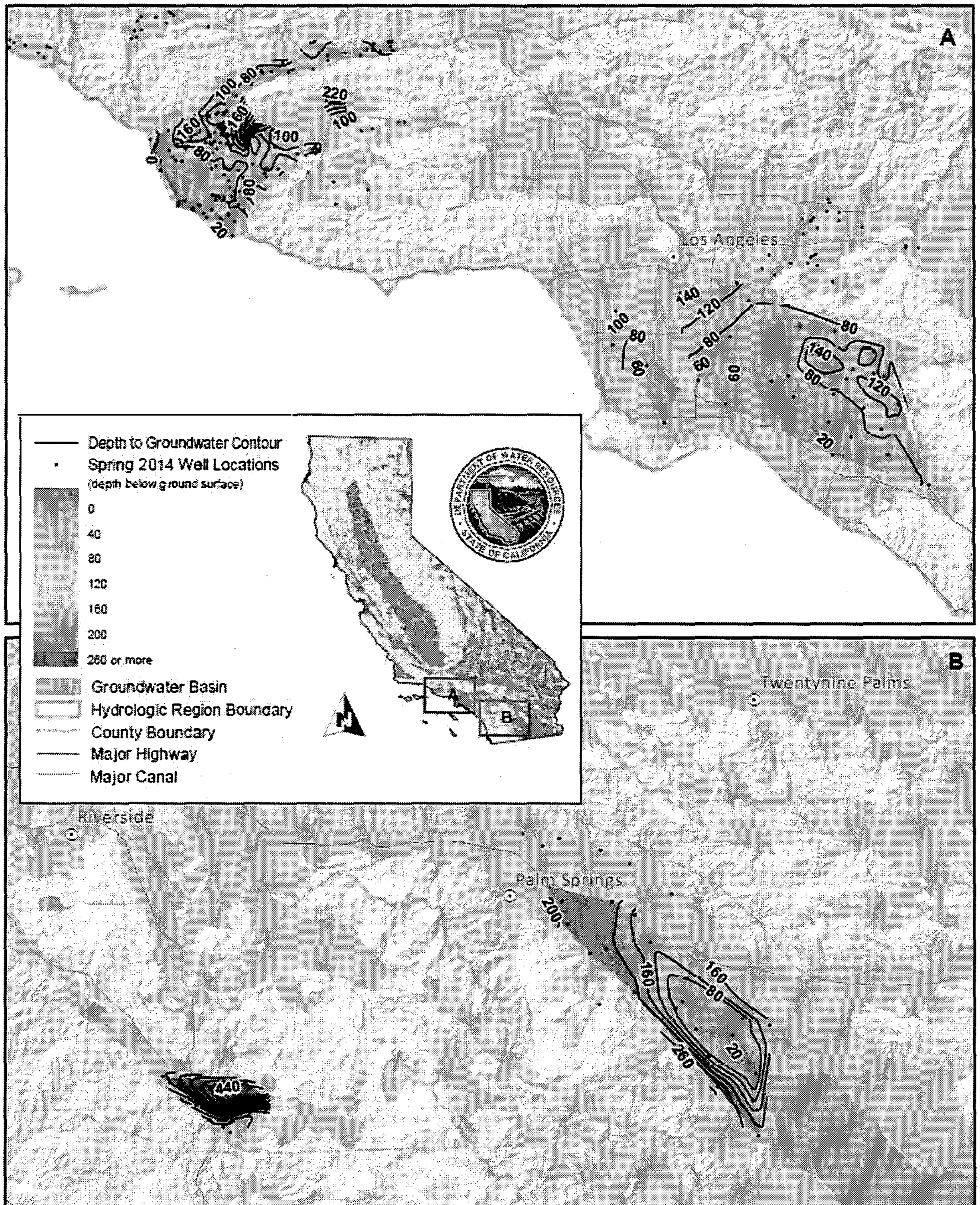
Depth to groundwater determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/16/2014. Document Name: S2014_DBGS_NorthCV_20140415
Updated: 04/21/2014 Data subject to change without notice.

Figure 7 - Depth to Groundwater - Spring 2014
Selected Groundwater Basins in South Central California



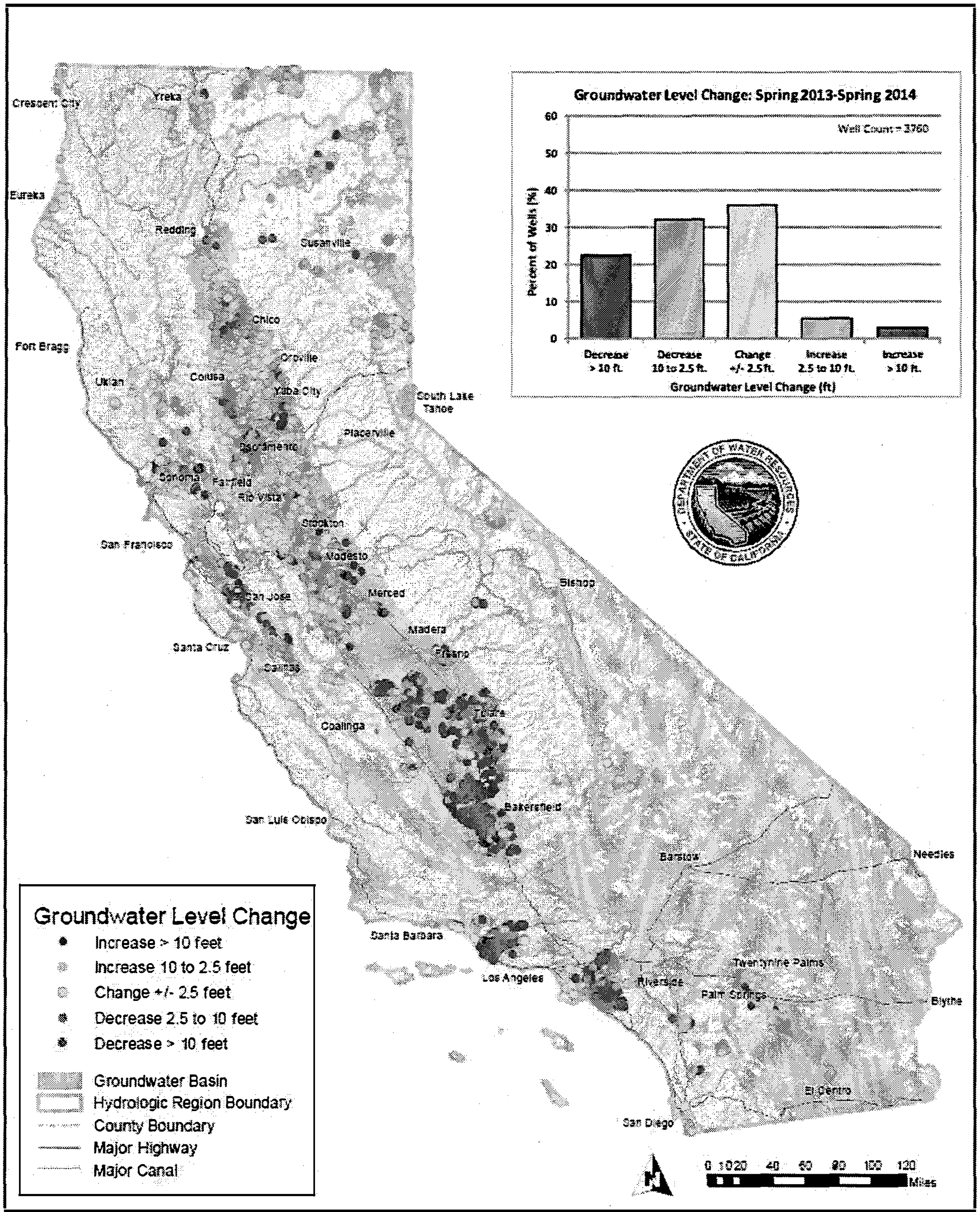
Depth to groundwater determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/16/2014. Document Name: S2014_DBGS_SouthCV_20140415 Updated: 04/21/2014 Data subject to change without notice.

Figure 8 - Depth to Groundwater - Spring 2014
Selected Groundwater Basins in Southern California



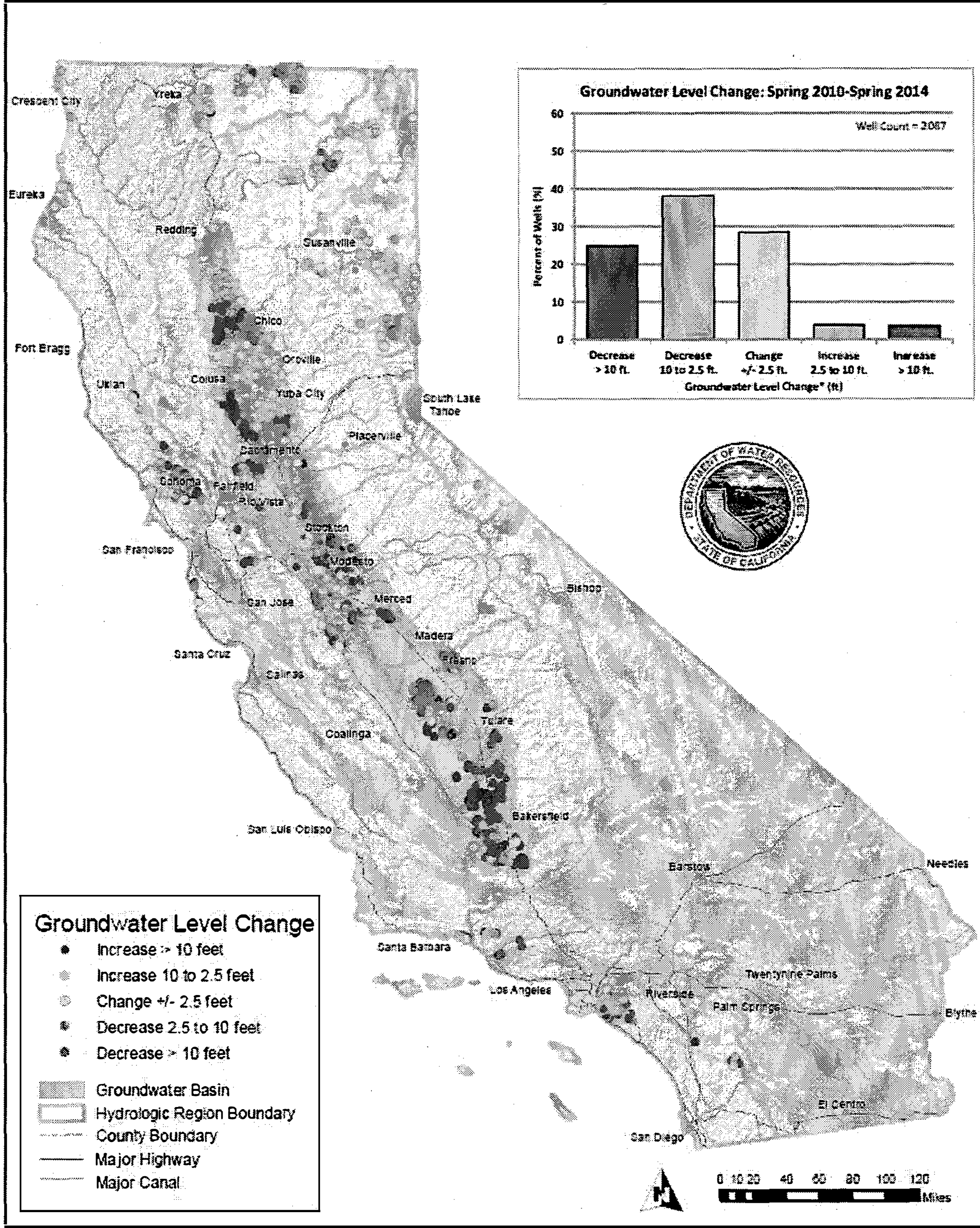
Depth to groundwater determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/16/2014. Document Name: S2014_DBGS_SoCal_20140415
Updated: 04/21/2014 Data subject to change without notice.

Figure 9 - **Groundwater Level Change* - Spring 2013 to Spring 2014**



*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/15/2014. Document Name: DOTMAP_S2013_S2014 Updated: 04/21/2014 Data subject to change without notice.

Figure 10 - **Groundwater Level Change* - Spring 2010 to Spring 2014**



*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/15/2014. Document Name: DOTMAP_S2010_S2014 Updated: 04/21/2014 Data subject to change without notice.

A more detailed method of evaluating regional differences in groundwater levels is through the use of groundwater contour change maps. Groundwater contour maps require data collected using guidelines related to the timing of data collection and the type of wells that are measured. Groundwater level change contours represent lines of equal groundwater level change. The shape, distribution, and extent of these contours also help identify the regional distribution and local magnitude of groundwater level changes. Furthermore, regional groundwater contour maps provide information about the groundwater levels where appropriate data exist and also illustrate where data is absent. Figures 11 and 12 depict regional change in groundwater levels for the Central Valley for spring 2013 to spring 2014.

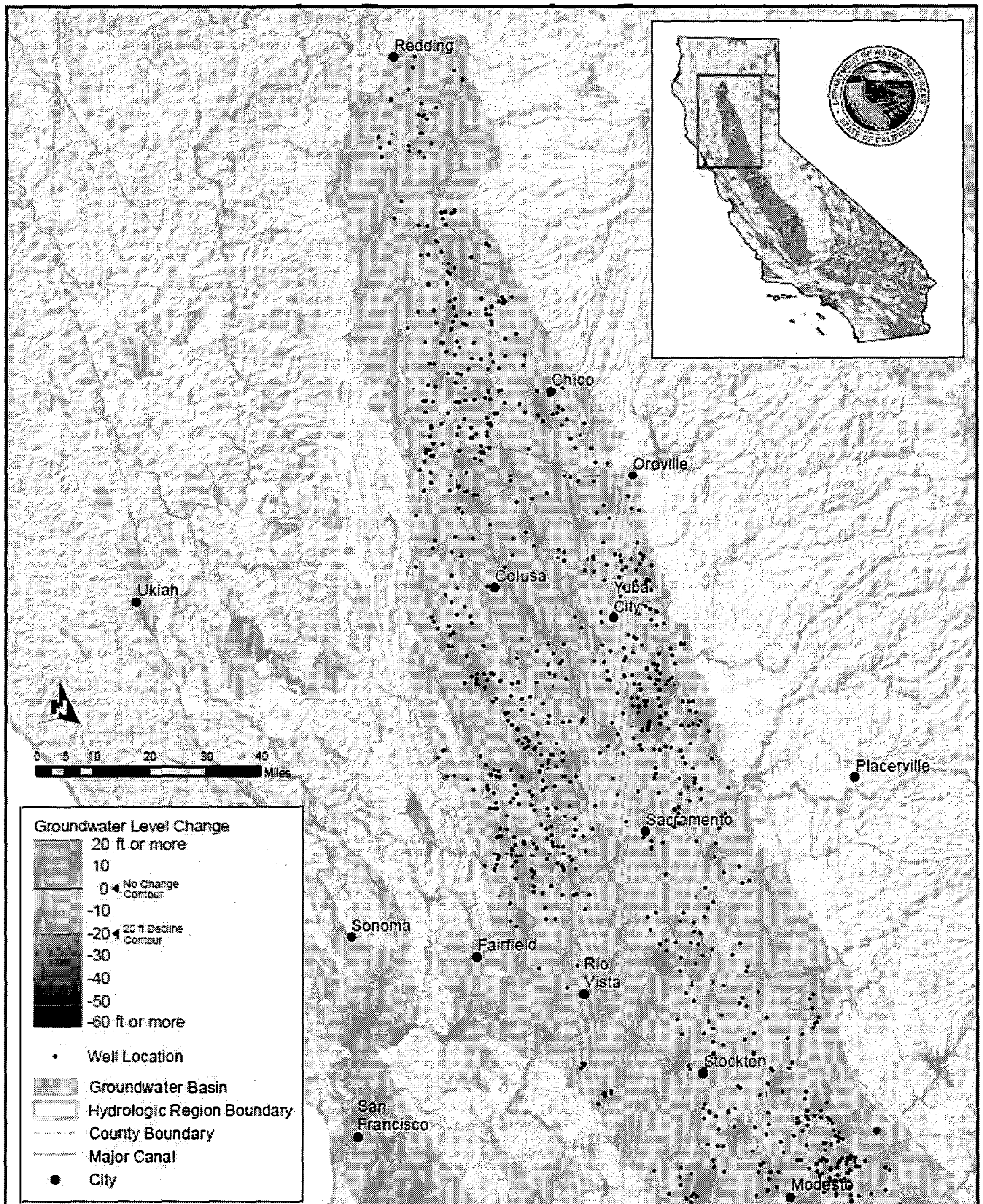
Analysis of historical groundwater levels at discrete locations was also completed to evaluate recent groundwater lows compared to former historical lows. Figure 13 depicts the comparison of historical low spring levels collected between spring 1900 to 1998 to more recent low spring levels collected between spring 2008 to 2014. Since spring 2008, groundwater levels are at all-time historical lows (for period of record) in most areas of the state and especially in the northern portion of the San Francisco Bay Hydrologic Region, the southern San Joaquin Valley, and also for the South Lahontan and South Coast hydrologic regions – these areas exhibit groundwater levels more than 50 feet below previous historical lows experienced sometime prior to 2000. There are many areas of the San Joaquin Valley where recent groundwater levels are more than 100 feet below previous historical lows.

4.4 Key Hydrographs

Hydrographs depict groundwater levels for a specific well plotted over time. These graphs allow for the analysis of seasonal and long-term groundwater level variability and trends over the time period of record. For this Update, some of the same wells and hydrographs used for the draft Bulletin 160 *California Water Plan Update 2013* (www.waterplan.water.ca.gov/cwpu2013) were updated with recent groundwater level data. Due to the highly variable nature of the aquifer systems within each groundwater basin, and the effects of annual groundwater availability, recharge, and surrounding land use practices, the hydrographs presented herein are not intended to illustrate or depict aquifer conditions over a broad region. The selected hydrographs are intended to portray how the local groundwater levels respond to changing conditions over time and how the local aquifer has responded to recent drought conditions.

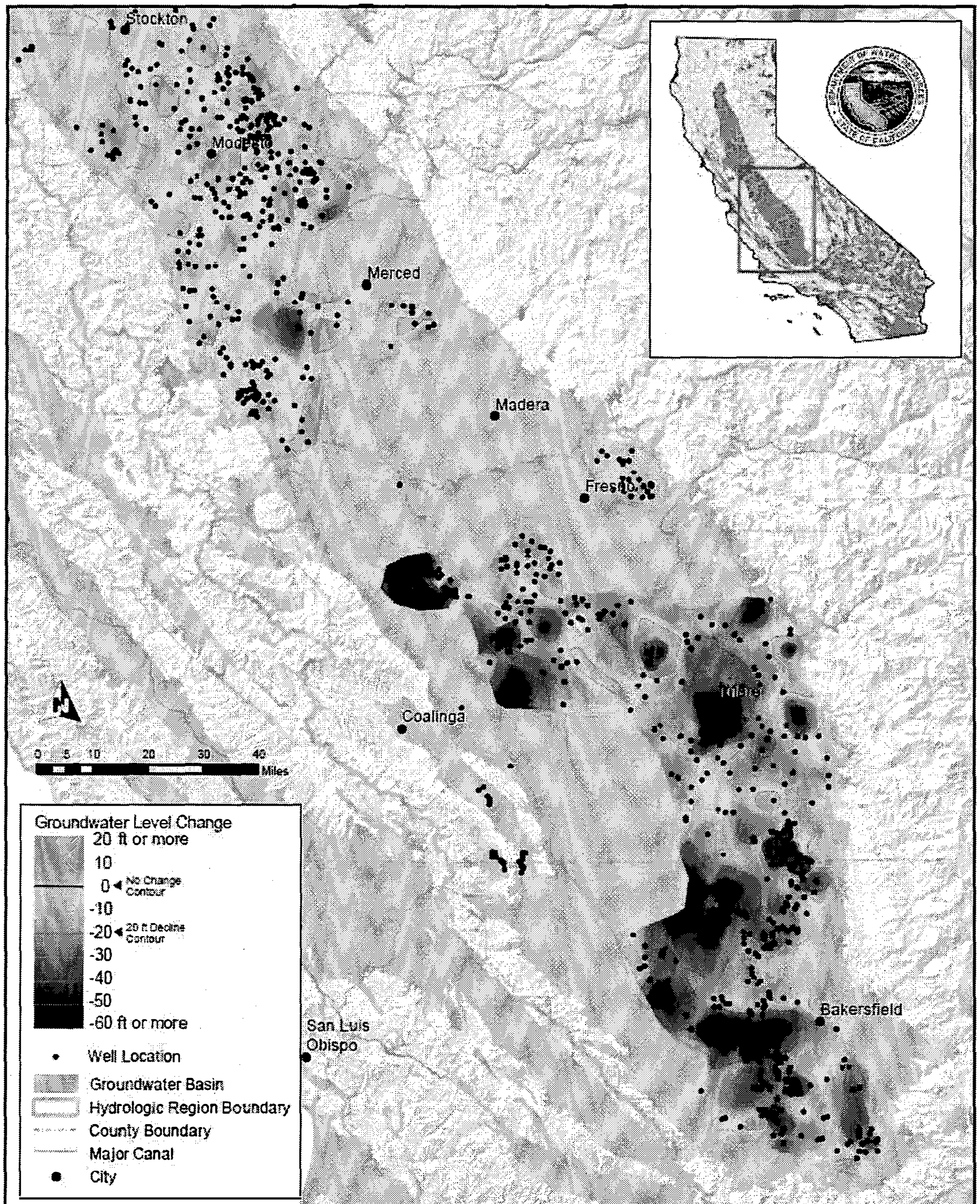
The wells selected for this analysis had spring 2013 and/or spring 2014 groundwater data available as of April 9, 2014. There are a total of 12 wells and six hydrologic regions included herein. The selection of wells is not exhaustive, yet they illustrate response to current drought conditions. The spring measurements typically indicate the previous year's total groundwater extractions minus any recharge to the aquifer. Lower recharge due to dry conditions in 2012 and 2013 is expected to cause a reduction of groundwater in the aquifers, which is reflected in lower groundwater elevations. For each hydrologic region, the location of the wells and corresponding hydrographs are shown in Figures 14 through 19. The hydrographs are designated according to the State Well Number System (SWN), which identifies each well by its location using the Public Land Survey System of township, range, section, and tract. The following narratives correlate with the selected wells and hydrographs, grouped by hydrologic region.

Figure 11 - Groundwater Level Change – Northern Central Valley, Spring 2013 to Spring 2014



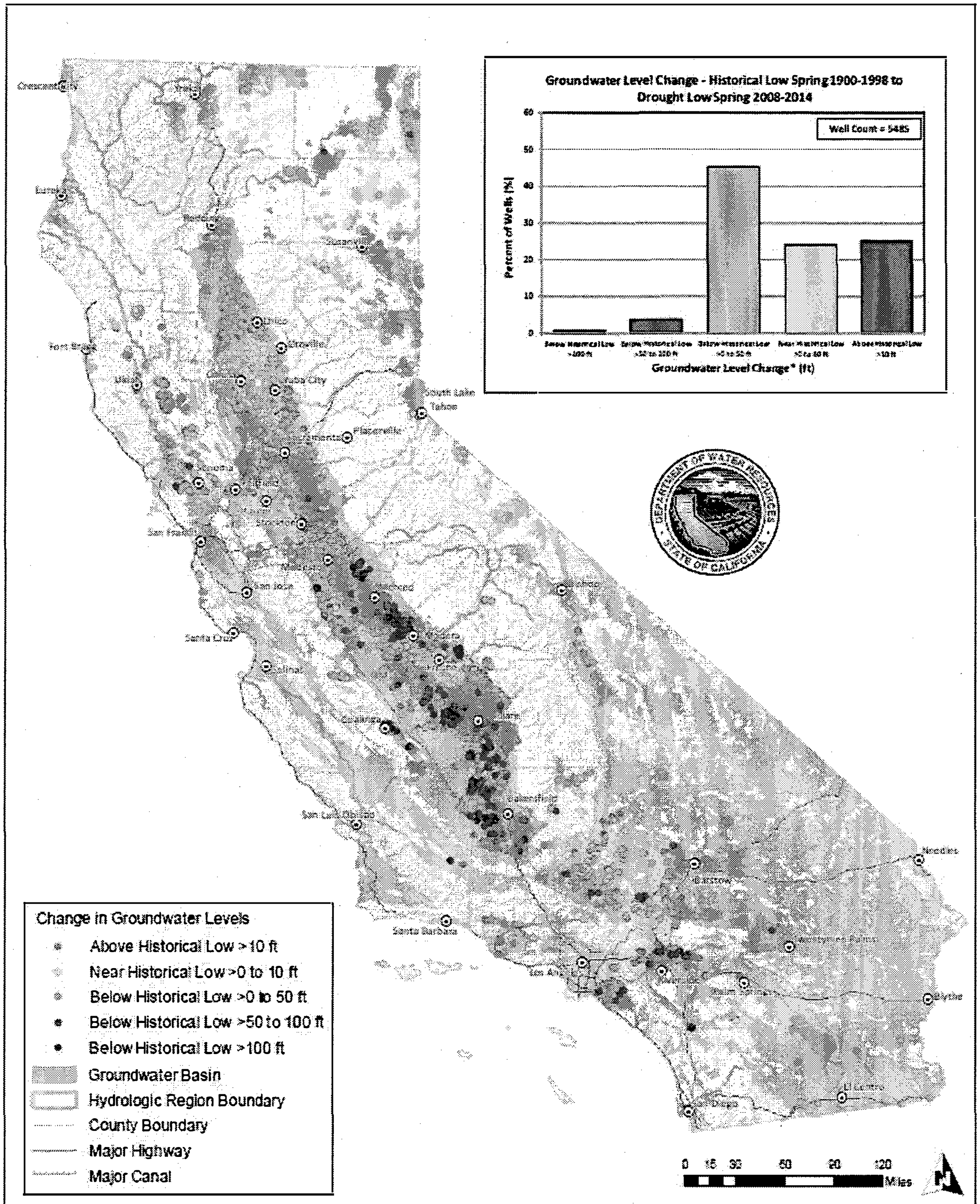
Depth to groundwater determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/16/2014. Document Name: S2013toS2014_NCV_20140416
Updated: 04/21/2014 Data subject to change without notice.

Figure 12 - Groundwater Level Change – Southern Central Valley, Spring 2013 to Spring 2014



Depth to groundwater determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/16/2014. Document Name: S2013toS2014_SCV_20140416
Updated: 04/21/2014 Data subject to change without notice.

Figure 13 - **Groundwater Level Change* – Historical Low Spring 1900-1998 to Drought Low Spring 2008-2014**



*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/15/2014. Document Name: Historical_Low_Spring_Map_Final Updated: 04/23/2014 Data subject to change without notice.

North Coast Hydrologic Region – Figure 14

Hydrograph 48N03E34N001M is for an irrigation well in the Tule Lake Subbasin of Klamath River Valley in the northern part of the state near the Oregon border. Relatively stable water levels existed through 2008 followed by declining levels through 2013 with a slight recovery during 2010 and 2011. For this well, the groundwater levels declined nearly 17 feet from 2008 to 2013.

Hydrograph 43N06W33C001M is for an irrigation well in the Shasta Valley Basin near the town of Gazelle in northern California. Water levels generally declined with some increase during the mid-1980s and late 1990s wet year periods. From 2011 to 2013, water levels declined about seven feet.

Hydrograph 07N09W35D002M is for a domestic well in the Santa Rosa Plain Subbasin (Santa Rosa Valley) in the city of Sebastopol, north of San Francisco. Relatively stable water levels have persisted throughout the record except during the 1976-1977 drought. Recently, the water levels declined about seven feet from 2010 to 2013.

San Francisco Bay Hydrologic Region– Figure 15

Hydrograph 05N06W02N002M is for a domestic well in the Sonoma Valley Subbasin (Napa-Sonoma Valley) in the city of El Verano, northwest of Sonoma. The surrounding area is agricultural. Water levels in this well generally show a long-term decline of about two feet per year. The water levels were relatively stable from 1974 to 2000, followed by declining water levels through 2014. The water levels have declined nearly 20 feet since 2012.

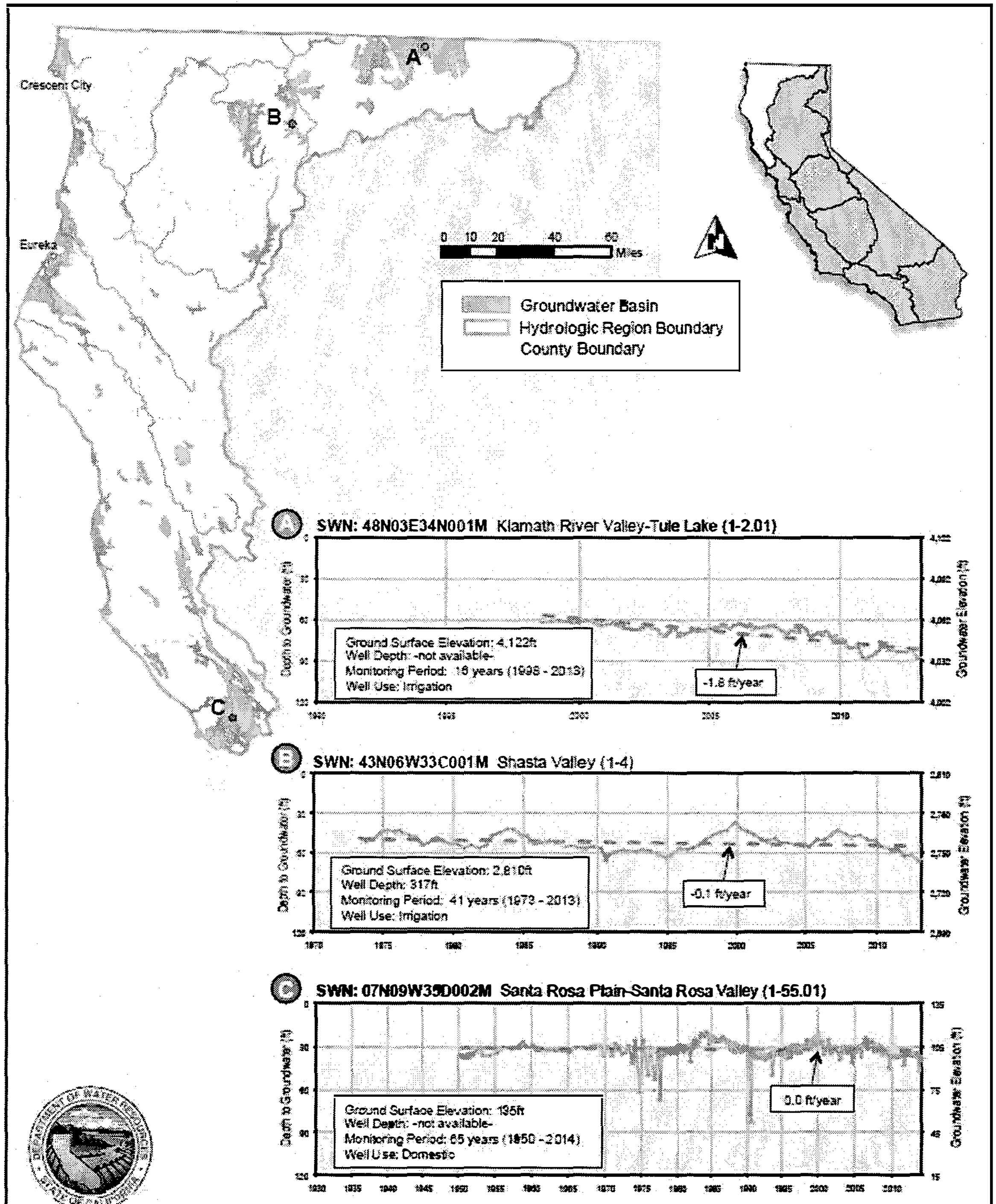
Sacramento River Hydrologic Region– Figure 16

Hydrograph 38N07E23E001M is for a domestic well in the Big Valley Basin. The Big Valley area is occupied by rural cattle ranching and hay cropping and is largely dependent on groundwater for irrigation during dry years. Water levels have fluctuated between about five to eight feet during average water years, and between about 15 to 20 feet during drought periods. Historical spring groundwater levels show gradual decline associated with the 1987-1993 drought and partial recovery after 2001. Declining water levels over time indicate that groundwater extraction is exceeding aquifer recharge in this area. Some water level recovery is noted during the 2010 and 2011 water years, yet water levels declined about 18 feet from 2012 to 2013.

Hydrograph 21N03W33A004M is for an irrigation well in the Colusa Subbasin (Sacramento Valley) in Glenn County between Orland and Willows. Water levels generally declined during the 1970s and prior to import of surface water through the Tehama-Colusa Canal. During the 1980s, groundwater levels recovered due to import and use of surface water supply and because of the 1982 to 1984 wet water years. Water levels declined again in the 2008 drought period, followed by a brief recovery during 2010 to 2011, and then returning to 2008 levels (which are notably lower than the 1977-79 drought levels).

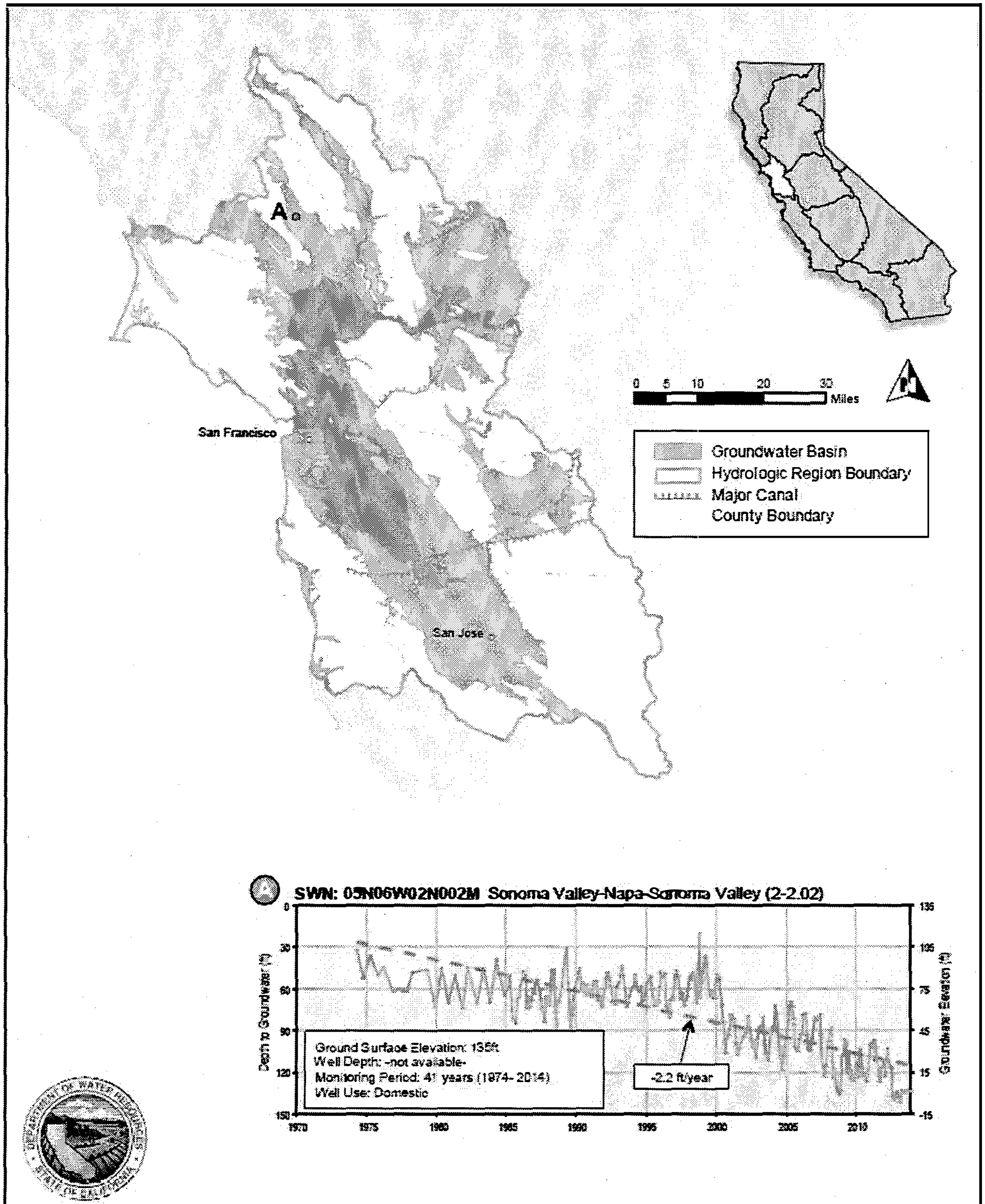
Hydrograph 15N03W01N001M is for an industrial well in the Colusa Subbasin (Sacramento Valley) in Colusa County, north of Williams. The surrounding area is agricultural. Groundwater levels generally declined until 1978 and then recovered during the 1982-1984 wet years. After the 2008-2009 drought, water levels declined to historical lows. Water levels recovered quickly during 2010 and 2011, then after returned to the trend of long-term decline.

Figure 14 - Selected Hydrographs – North Coast Hydrologic Region



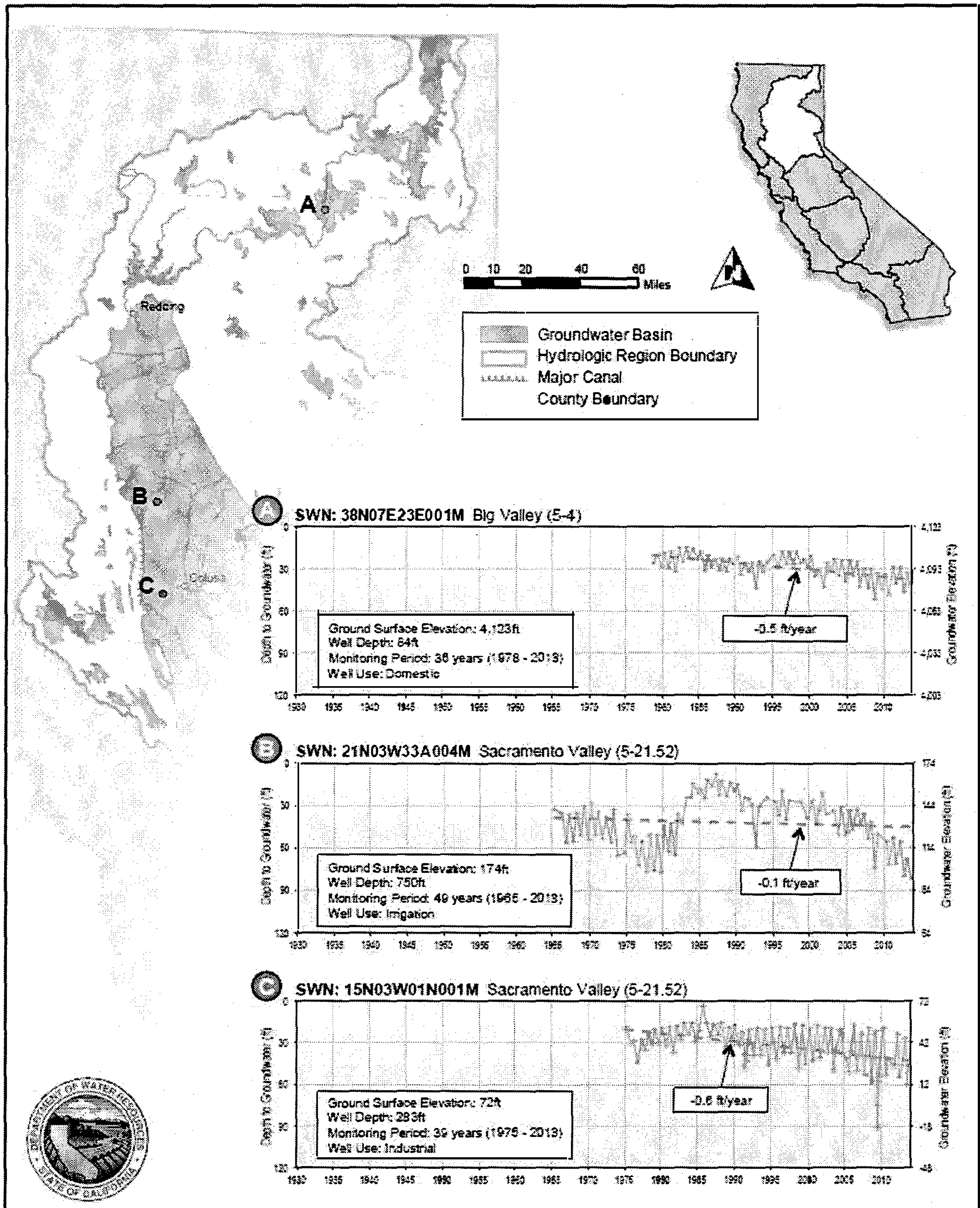
Hydrographs based on available data from the DWR Water Data Library as of April 9, 2014. Data subject to change.

Figure 15 - **Selected Hydrographs – San Francisco Bay Hydrologic Region**



Hydrographs based on available data from the DWR Water Data Library as of April 9, 2014. Data subject to change.

Figure 16 - **Selected Hydrographs – Sacramento River Hydrologic Region**



Hydrographs based on available data from the DWR Water Data Library as of April 9, 2014. Data subject to change.

San Joaquin River Hydrologic Region– Figure 17

Hydrograph 05S12E11G001M is for an irrigation well in the Turlock Subbasin (San Joaquin Valley) within the Eastside Water District, approximately 10 miles east of Turlock. The area lacks surface water and is solely dependent on groundwater. Water levels have generally declined over time. Water levels stabilized from about 1990 to 2002 likely due to utilization of efficient irrigation techniques. During 2003 and 2004, increased agricultural activity may have contributed to the declining water levels. From 2011 to 2013, the water levels declined nearly 20 feet. From 1970 to 2013, the water levels have declined a total of about 96 feet.

Hydrograph 11S10E24N001M is for an industrial well in the Delta-Mendota Subbasin (San Joaquin Valley) in western Merced County. Although water levels generally increased from 1960 to 2000, there has been a decline of almost 30 feet since 2001.

Tulare Lake Hydrologic Region– Figure 18

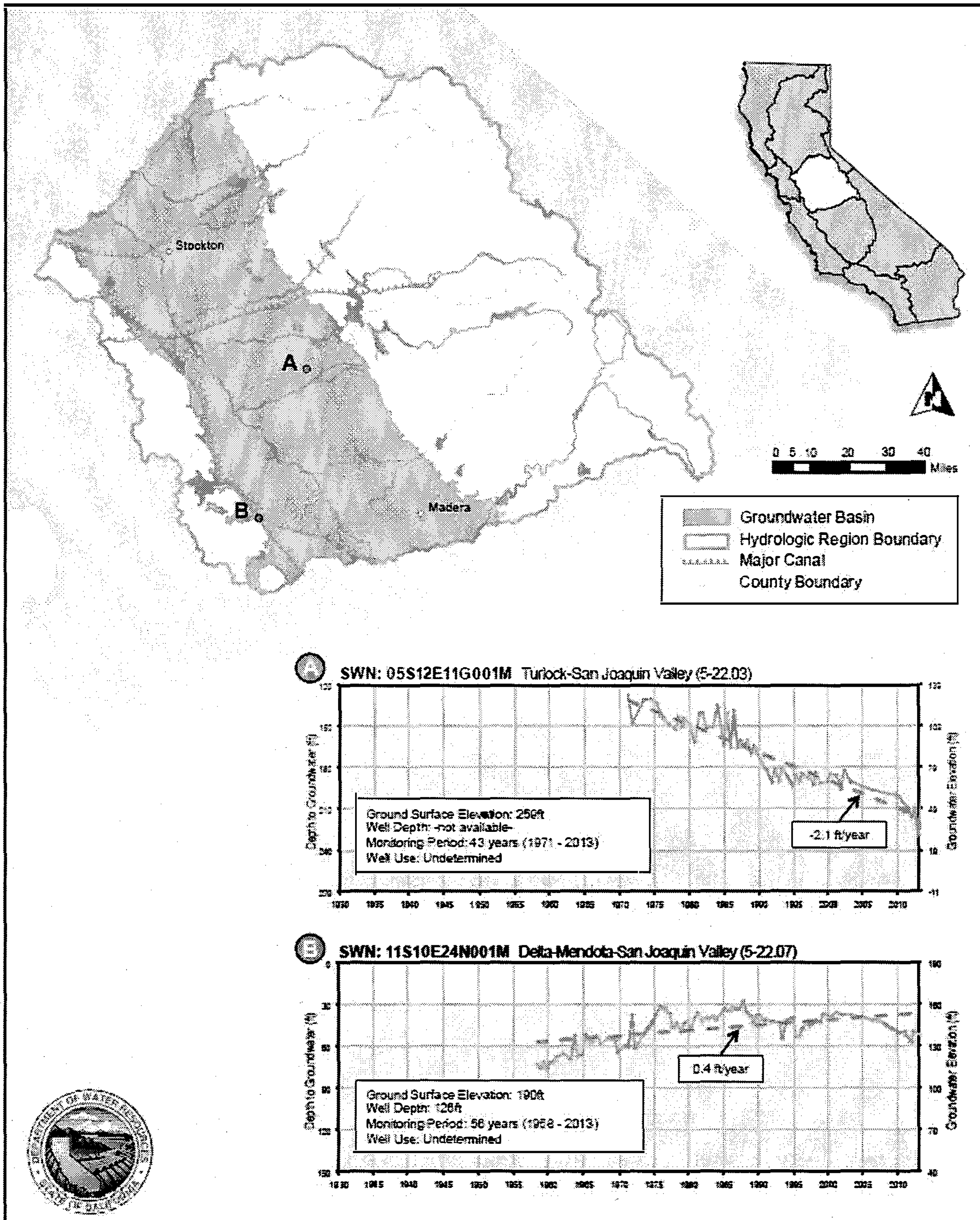
Hydrograph 25S26E16P001M is for an observation well in the Kern County Subbasin (San Joaquin Valley) near the Friant-Kern Canal in northern Kern County. Due to increased surface water deliveries from the Friant-Kern Canal and reduced demand on groundwater, water levels generally increased from the mid-1960s. Water levels declined slightly during 1977 and 1978 and then increased more than 30 feet during the wet years of the mid-1980s. From 1990 to 2006, the water levels remained relatively stable. Water levels declined in 2008 and 2009 then stabilized during the above average water years of 2010 and 2011. From 2007 to 2013, water levels declined a total of almost 60 feet.

North Lahontan Hydrologic Region– Figure 19

Hydrograph 29N12E16M002M is for a domestic well in the Honey Lake Valley Basin. Groundwater levels generally show a gradual decline over time, yet some recovery is noted after the 1976-1977 and the 1988-94 drought periods. Groundwater levels were at all-time lows after the 2008-2009 drought; about 25 feet below the water levels observed during the 1976-1977 drought and about 15 feet below the levels observed during the 1987-1992 drought. Water levels recovered and generally increased after the above average water year in 2011, and then declined again in 2012 and 2013 to near record lows.

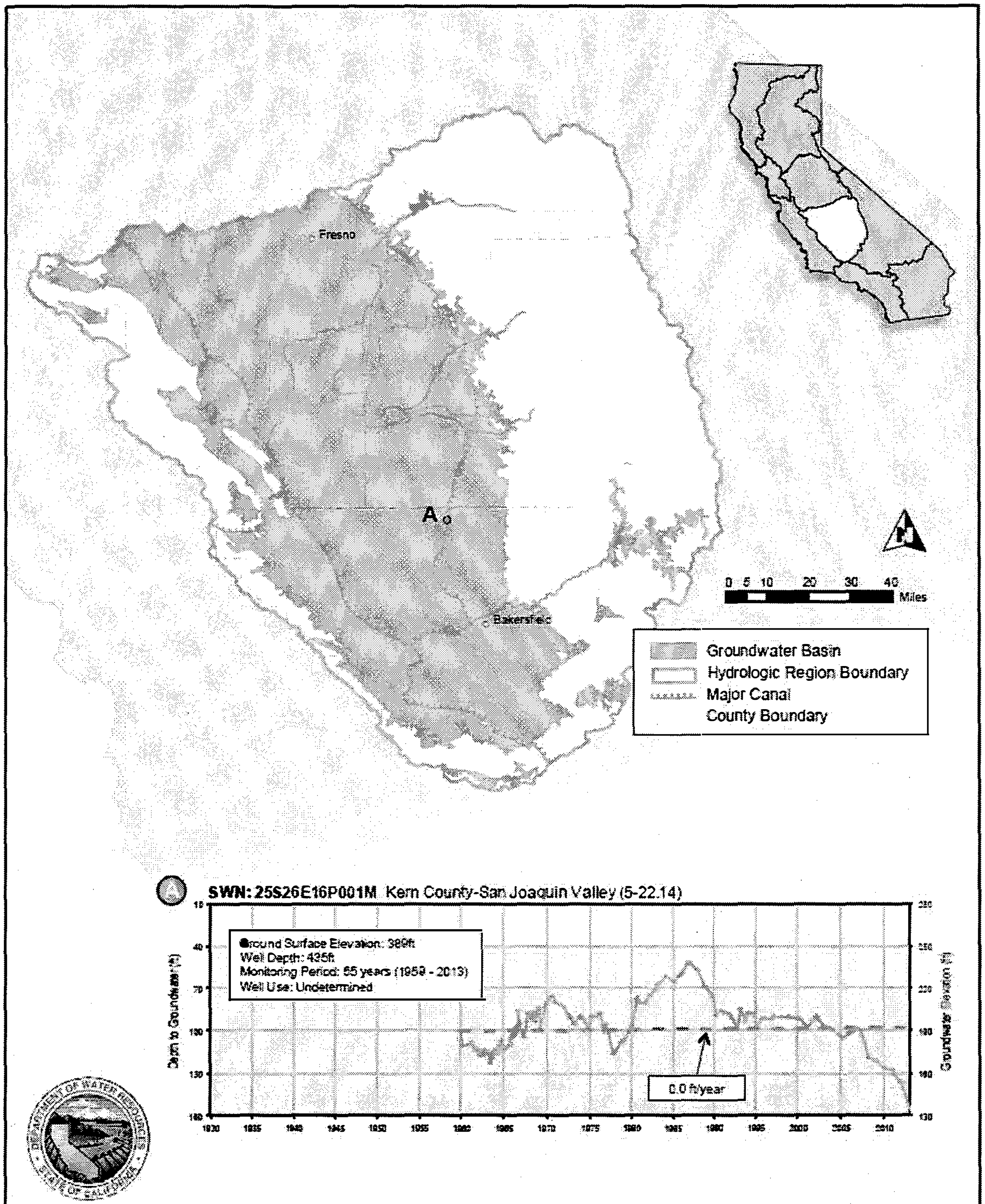
Hydrograph 17N17E29B001M is for an observation well in the Martis (Truckee) Valley Basin on the eastern edge of Truckee. Water levels were relatively stable through 2007 and then abruptly declined during the 2008-2009 drought period. Water levels recovered nearly 27 feet during the 2010 to 2011 above-average water year period, and then declined almost 30 feet during the 2012-2013 drought period.

Figure 17 - Selected Hydrographs – San Joaquin River Hydrologic Region



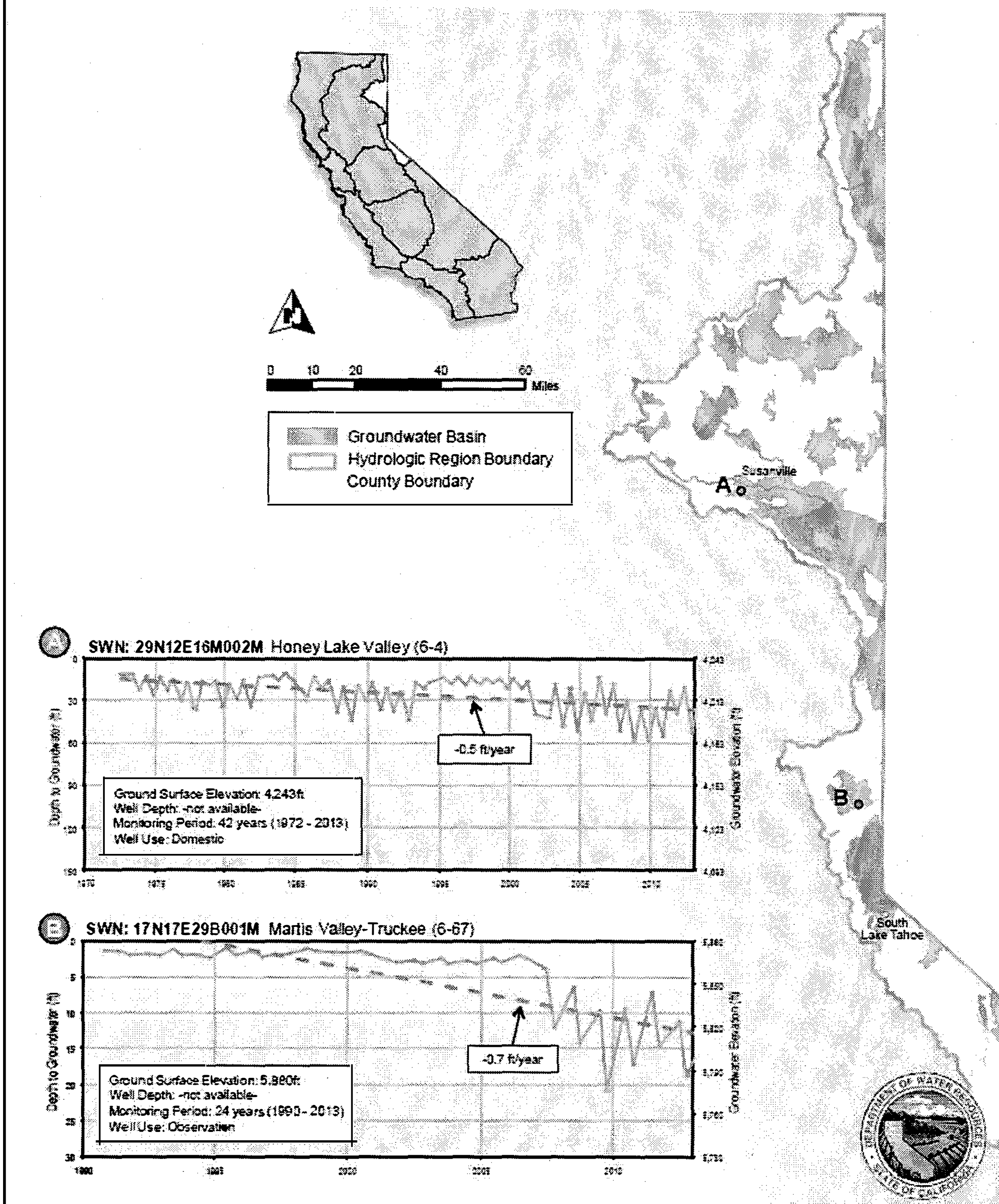
Hydrographs based on available data from the DWR Water Data Library as of April 9, 2014. Data subject to change.

Figure 18 - Selected Hydrographs – Tulare Lake Hydrologic Region



Hydrographs based on available data from the DWR Water Data Library as of April 9, 2014. Data subject to change.

Figure 19 - Selected Hydrographs – North Lahontan Hydrologic Region



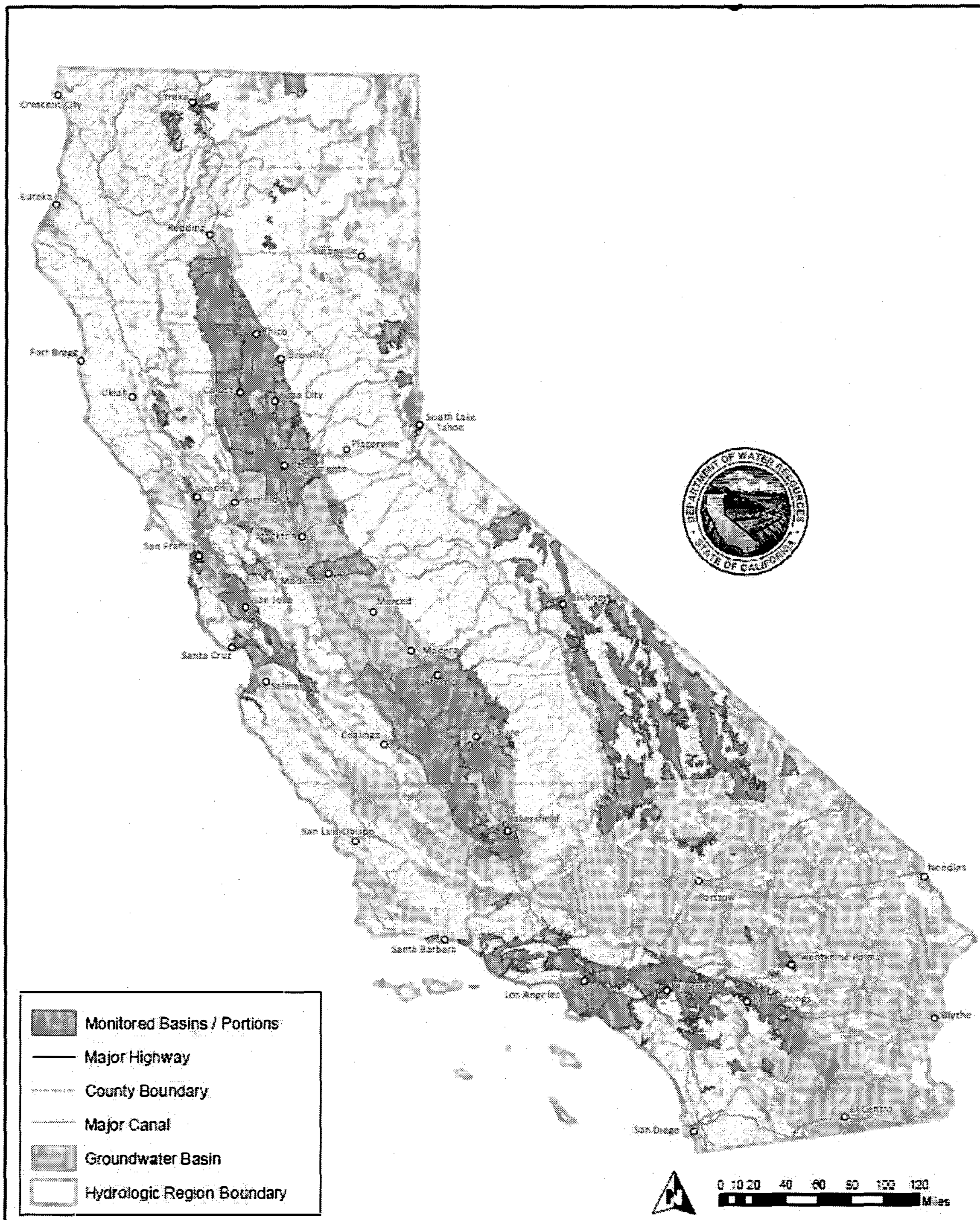
Hydrographs based on available data from the DWR Water Data Library as of April 9, 2014. Data subject to change.

5.0 GAPS IN GROUNDWATER MONITORING

A groundwater monitoring gap is an informal term indicative of insufficient data to reasonably assess and interpret groundwater conditions in an aquifer or in a basin. There are two primary gaps that can exist in groundwater monitoring data; spatial and temporal. Spatial data gaps exist where there is inadequate horizontal and/or vertical distribution of groundwater elevation data to accurately represent or assess aquifer conditions within an area of interest (groundwater basin). Sufficient vertical distribution of data is important in groundwater basins having multiple aquifer systems at various depths, and that may also be characterized by varying levels of confinement or changing groundwater elevations. A thorough understanding of a groundwater basin's hydrogeology is essential to assess whether or not the spatial distribution of monitoring wells is adequate for a basin. Groundwater elevation data collected at routine intervals can provide seasonal and long-term trends for a basin, which are essential for accurately estimating aquifer response and change in storage associated with changing hydrology, land use, total water supply, and effects of local groundwater management practices. Temporal data gaps exist when a consistent record of groundwater elevation data, recorded over regular time intervals, is not available.

Before the CASGEM Program originated in 2009, much of the available groundwater elevation data was sourced from the WDL database. This database contained information from wells monitored by DWR and numerous cooperating agencies. While the spatial coverage was adequate in some areas of the state, evaluation of groundwater levels during the 2009 drought conditions identified data gaps in groundwater level information for most basins. In addition, well construction information was not readily available to the public due to well log confidentiality, further limiting adequate analysis of groundwater conditions in some basins. Implementation of the CASGEM Program facilitated the submittal of groundwater elevation data for many areas of the state where data was previously unavailable (www.water.ca.gov/groundwater/casgem). Monitoring Entities within the CASGEM Program are required to provide well construction information (well depth and screen intervals) for their CASGEM wells, which allows the groundwater elevation data obtained from those wells to be analyzed with increased confidence (www.water.ca.gov/groundwater/casgem/entities.cfm). Monitoring Entities are also required to obtain well owner permission prior to including their wells in the CASGEM Program, as all related data is required to be publically available. Some well owners have expressed reluctance to provide permission to the Monitoring Entity to monitor their wells and publicly release the water level and well construction information. As a result, many CASGEM Monitoring Entities have not been able to readily address data gaps in their CASGEM monitoring networks. Absent the important combination of groundwater elevation data and associated well construction information, gaps will continue to exist in the CASGEM monitoring networks. Figure 20 illustrates the statewide distribution of groundwater basins monitored under the CASGEM Program as of April 8, 2014. Only 169 of the 515 alluvial groundwater basins/subbasins are fully or partially monitored under CASGEM.

Figure 20 - Groundwater Basins and Portions of Basins Monitored* under the CASGEM Program



*Groundwater basins, subbasins, and portions of basins that have CASGEM monitoring well networks or alternative monitoring programs, approved by DWR, are considered to be monitored. Based on available data, as of 4/08/2014. Updated 04/21/2014. Data subject to change without notice.

5.1 CASGEM Basin Prioritization

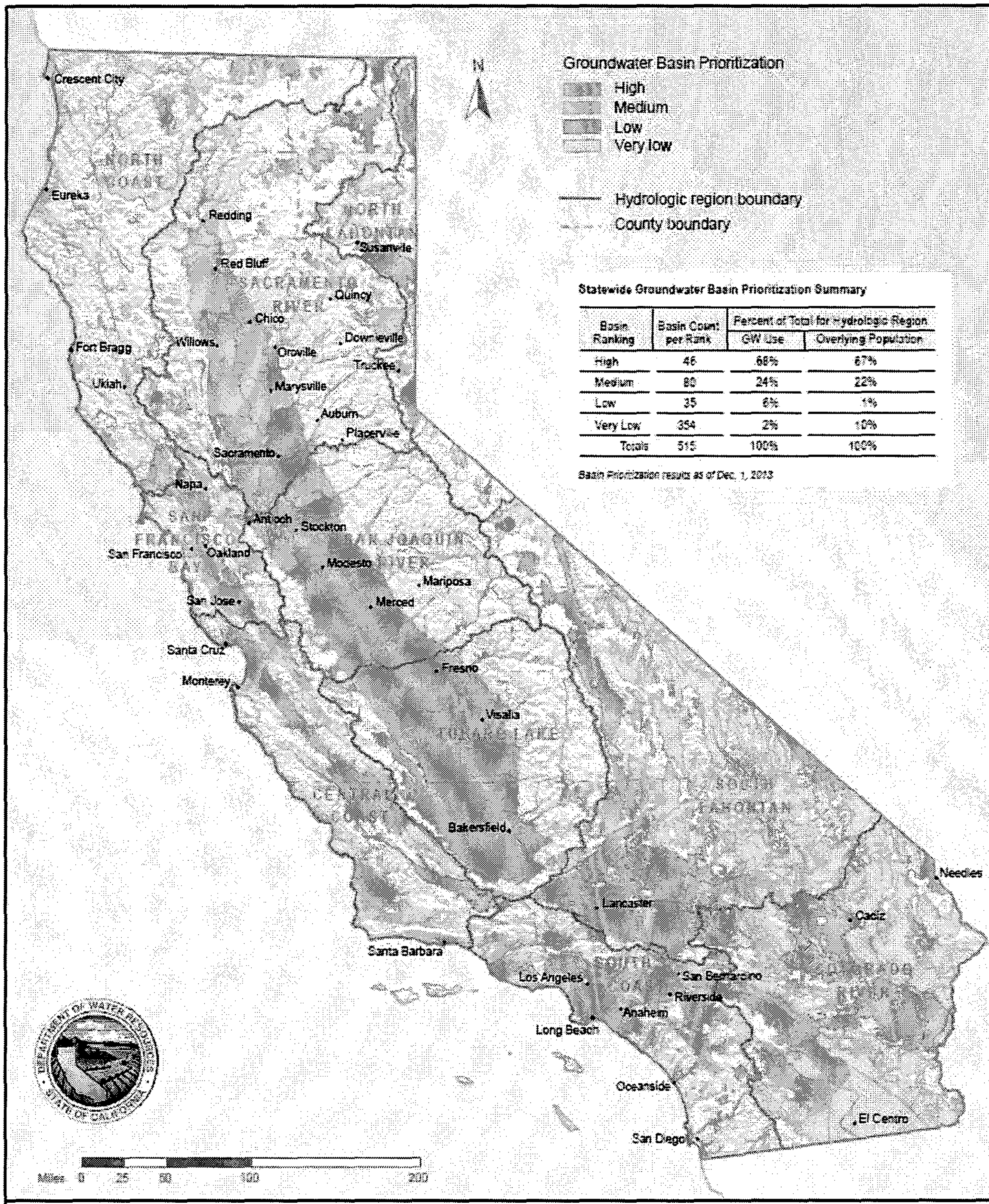
As described previously, the CASGEM basin prioritization process was developed to assess and rank the alluvial groundwater basins throughout the state. The basin prioritization process is based on an evaluation of the eight required data components specified in the California Water Code. DWR expects to finalize the draft basin prioritization process and results by May 2014.

As of December 2013, the draft basin prioritization results ranked 46 of the 515 alluvial groundwater basins as High Priority, 80 as Medium Priority, 35 as Low Priority, and 354 as Very Low Priority. Draft basin prioritization results also found that the 126 highest priority basins (High and Medium), approximately 24 percent of all of California's alluvial groundwater basins, account for close to 90 percent of California's annual groundwater use and about 90 percent of the population overlying the groundwater basins.

Figure 21 depicts the draft results of the Basin Prioritization. Many of the groundwater basins within the Central Coast and South Coast hydrologic regions, and most of the basins within the Central Valley, are ranked as either High or Medium priority. All of the groundwater basins within the Central Valley portion of the San Joaquin River and Tulare Lake hydrologic regions are ranked as High Priority. All but five of the groundwater basins in the Central Valley portion of the Sacramento River Hydrologic Region are ranked as High or Medium priority. The North Lahontan, South Lahontan, and Colorado River hydrologic regions have the lowest number of High and Medium priority groundwater basins, primarily due to the low groundwater use and population.

As of April 9, 2014, about 58 percent (73) of the High and Medium priority groundwater basins are fully monitored under the CASGEM Program. An additional 10 percent (13) of High and Medium priority basins are partially monitored under CASGEM. There are 32 percent (40) of the High and Medium priority basins not monitored under CASGEM. For 35 of the 40 unmonitored basins, there is a local agency that has indicated interest in participating in the CASGEM Program. The areas that lack participation in the CASGEM Program, and with no designated Monitoring Entity as of April 9, 2014, are considered gaps in groundwater monitoring for purposes of this Update. Figure 22 depicts the High and Medium priority basins which are currently not monitored under the CASGEM Program. There are significant monitoring gaps in the Sacramento, San Joaquin River, Central Coast, and South Lahontan hydrologic regions.

Figure 21 - Draft CASGEM Basin Prioritization



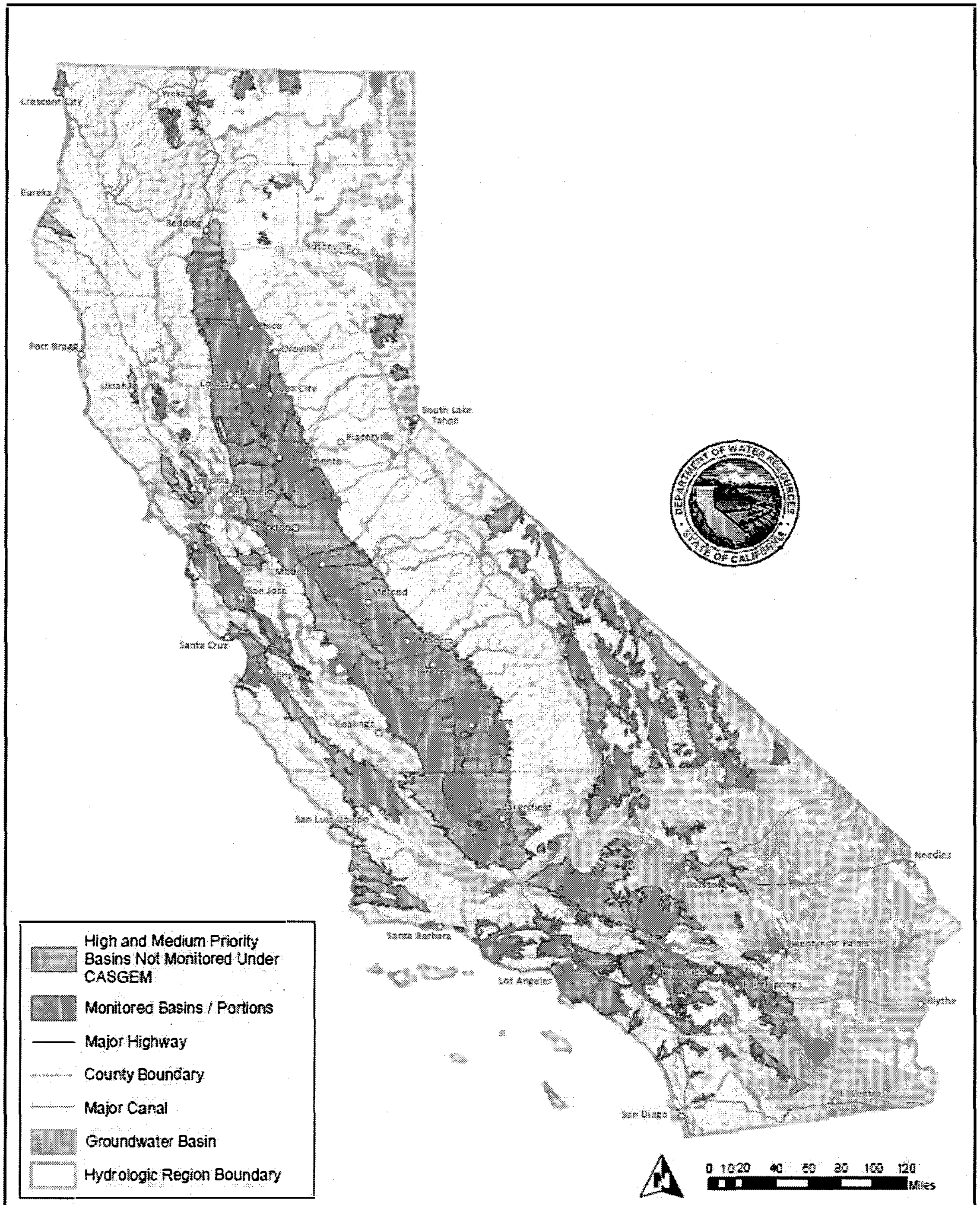
Statewide Groundwater Basin Prioritization Summary

Basin Ranking	Basin Count per Rank	Percent of Total for Hydrologic Region	
		GW Use	Overlying Population
High	46	68%	67%
Medium	80	24%	22%
Low	35	6%	1%
Very Low	354	2%	10%
Totals	515	100%	100%

Basin Prioritization results as of Dec. 1, 2013

Source: *Draft California Water Plan Update 2013*, Department of Water Resources. Information sourced from California Statewide Gr•undwater Elevation Monitoring Program, Draft Basin Prioritization Process and Results, •ecember 2013.

Figure 22 - Unmonitored High and Medium Priority Basins, and Monitored* Basins under the CASGEM Program



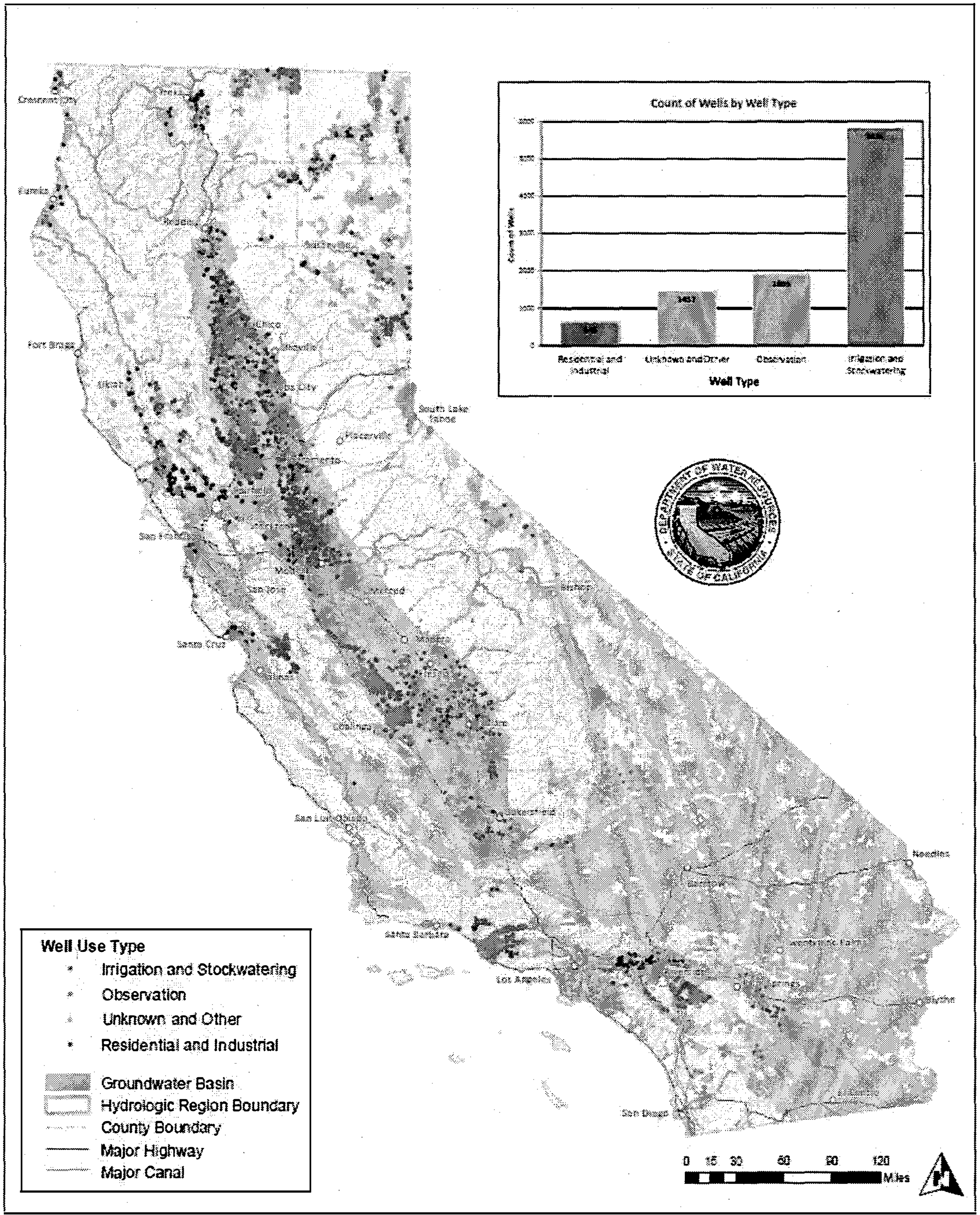
*Groundwater basins, subbasins, and portions of basins that have CASGEM monitoring well networks or alternative monitoring programs, approved by DWR, are considered to be monitored. Based on available data, as of 4/07/2014. Updated 04/22/2014. Data subject to change without notice.

5.2 Groundwater Level Monitoring Networks

After development of the CASGEM Online System, the historical data in WDL were transferred to an updated WDL groundwater level database that contains additional data fields specific to the CASGEM Program. Both the CASGEM Online System and WDL interface allow users to view the network of groundwater elevation monitoring locations throughout the state. The individual wells are classified as either "CASGEM" or "Voluntary" wells. CASGEM wells and measurements are used specifically for a CASGEM groundwater elevation monitoring network. Because CASGEM wells are required to be monitored with sufficient frequency to capture data that represents seasonal groundwater elevations within basins, they are also suitable for use in trend analyses. CASGEM wells may possess data prior to the start of the CASGEM Program due to migration of historical data to the updated WDL database, or submittal of historical data by the Monitoring Entity. Well construction information is not disclosed for "Voluntary" wells. While the groundwater elevation data that are provided for voluntary wells may be useful to observe trends in a given well, these data are less useful for conducting more extensive hydrologic analysis such as basin trends and elevation contouring, especially in groundwater basins that have multiple distinct aquifer zones. Figure 23 shows the statewide distribution of groundwater monitoring data for spring 2013. There are significant monitoring gaps in the San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions.

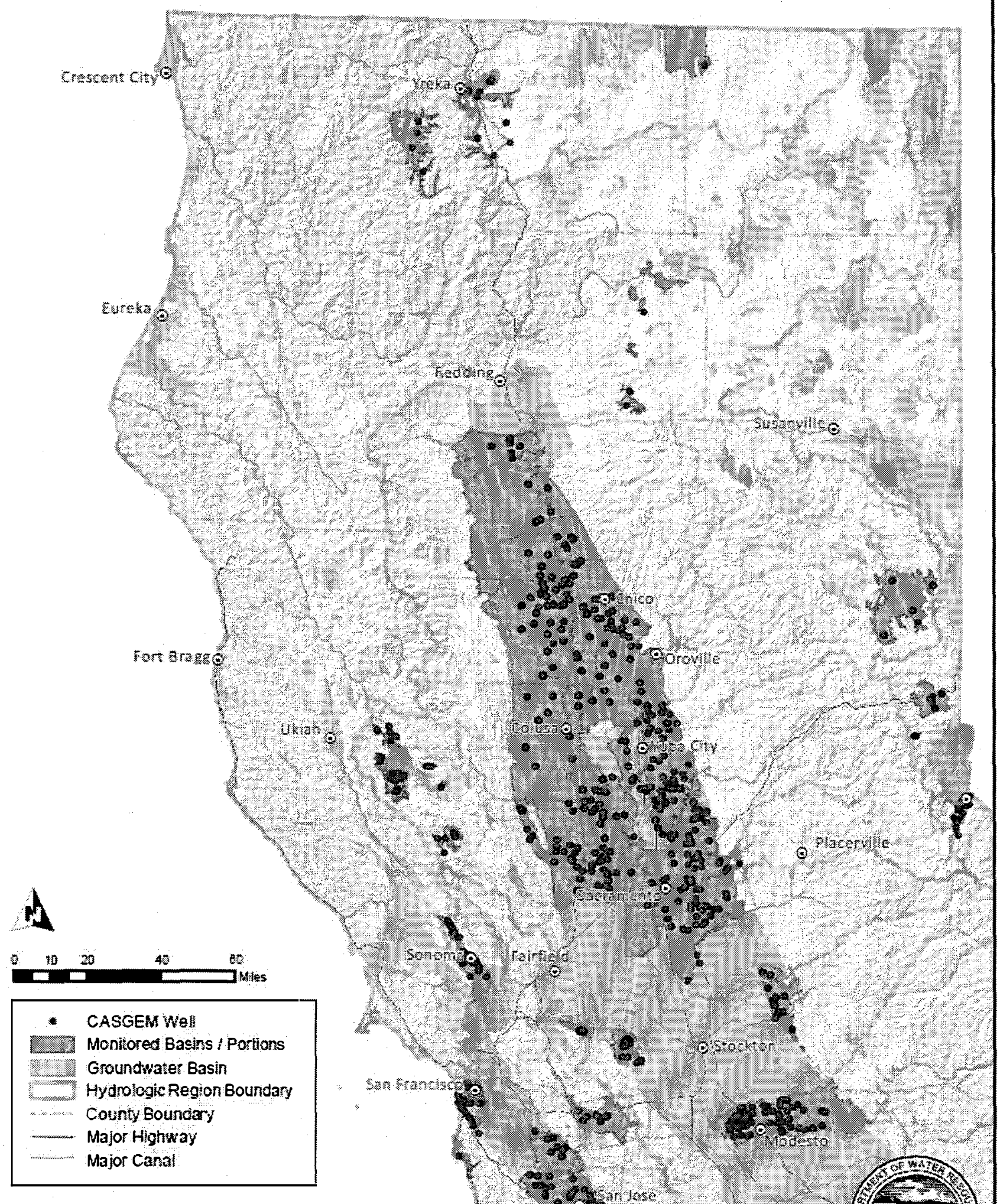
As of April 9, 2014, a total of 169 of the 515 alluvial groundwater basins have a designated Monitoring Entity under the CASGEM Program who is actively monitoring their CASGEM wells. Statewide, there are 4,122 CASGEM wells and 39,429 Voluntary wells represented in the WDL groundwater level database. Despite the monumental progress realized by implementation of the CASGEM Program during the past four years, additional work is needed to establish adequate statewide monitoring of the groundwater basins. There are gaps on a statewide scale – basins that are not yet being monitored under the CASGEM Program, as well as gaps on the basin scale – basins with spatial data gaps. DWR is working cooperatively with Monitoring Entities to improve the existing statewide CASGEM monitoring network and reduce data gaps. Figures 24 through 26 depict the existing CASGEM monitoring networks.

Figure 23 - Water Data Library Monitoring Distribution - Wells with Spring 2013 Data



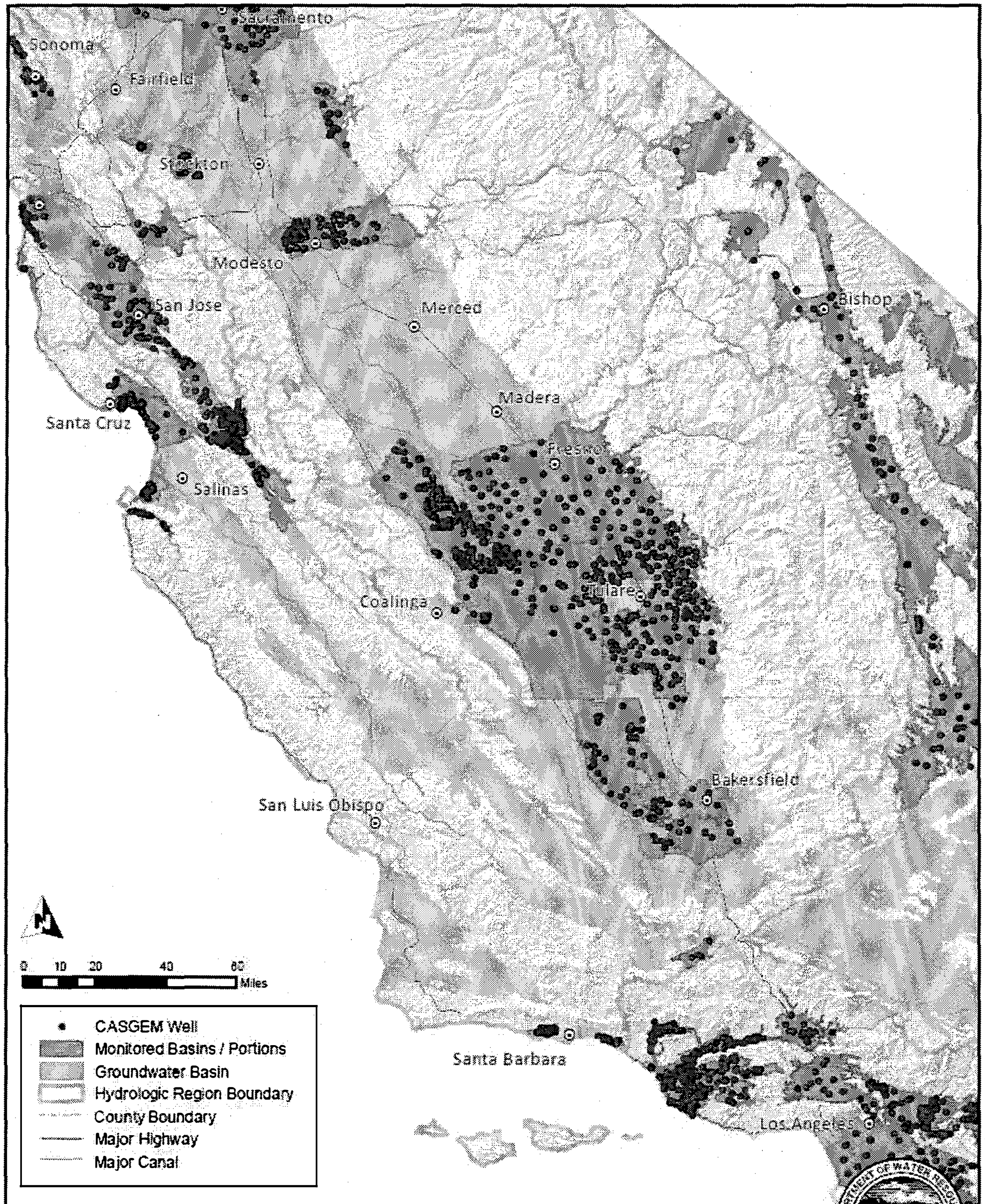
Map and chart based on available data from the DWR Water Data Library as of 03/28/2014.
Document Name: S2013_measured_wells Updated: 04/23/2014
Data subject to change without notice.

Figure 24 - Distribution of CASGEM Wells in Northern California



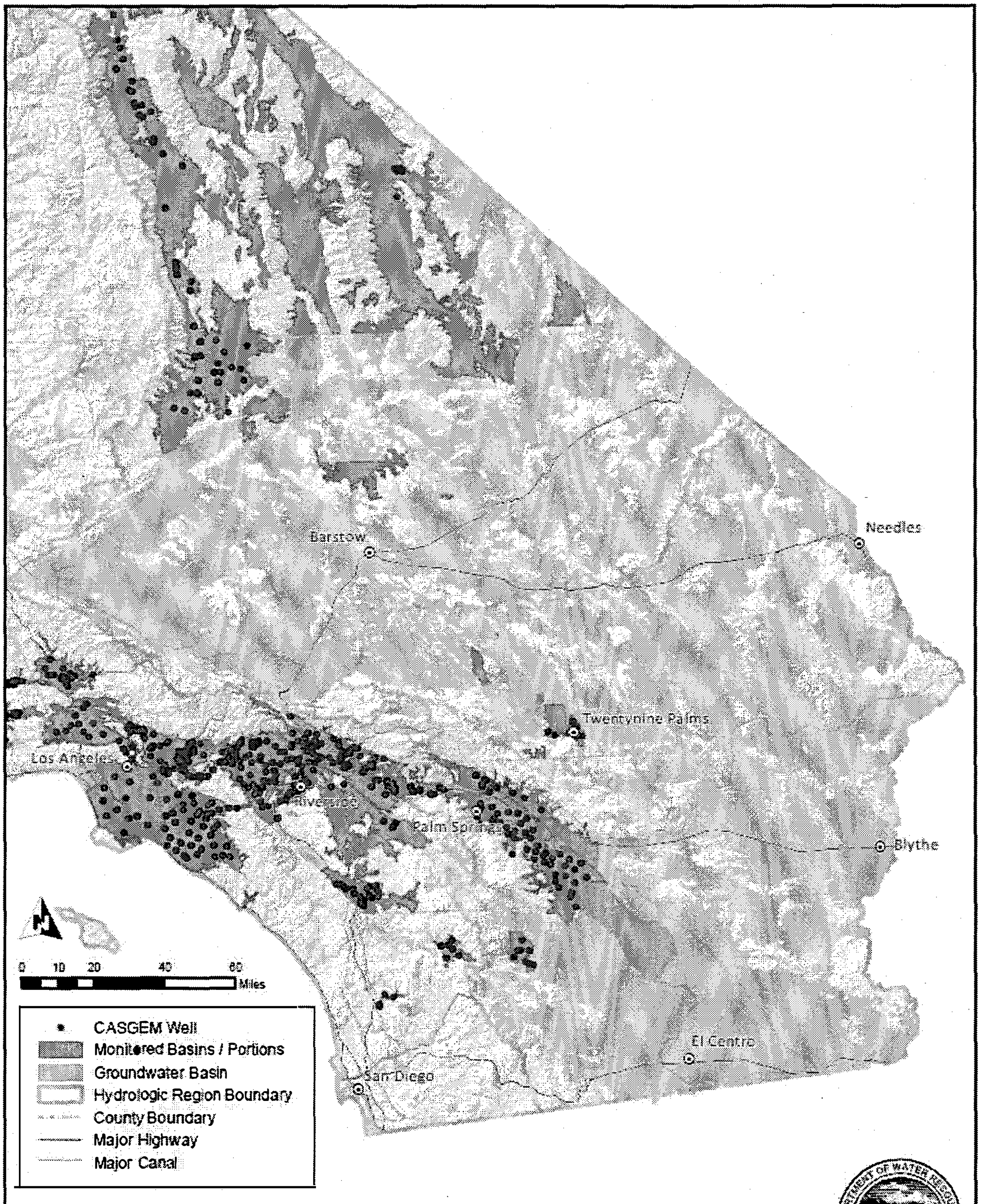
CASGEM well information is based on available data from the DWR Water Data Library as of 04/07/2014. Document Name: CASGEM_wells_NoCal_20140422
Updated: 04/23/2014 Data subject to change without notice.

Figure 25 - Distribution of CASGEM Wells in Central California



CASGEM well information is based on available data from the DWR Water Data Library as of 04/07/2014. Document Name: CASGEM_wells_CenCal_20140422
Updated: 04/23/2014 Data subject to change without notice.

Figure 26 - Distribution of CASGEM Wells in Southern California



CASGEM well information is based on available data from the DWR Water Data Library as of 04/07/2014. Document Name: CASGEM_wells_SoCal_20140422
Updated: 04/23/2014 Data subject to change without notice.

5.3 Groundwater Management

Groundwater plays a key role in meeting California's water supply needs. The effective management of groundwater basins is an essential aspect to maintaining the reliability and sustainability of this vital resource. Components that are essential to groundwater management programs include and/or address the following; basin management objectives (BMOs) with performance monitoring programs for groundwater levels, groundwater quality, land subsidence, and the interactions of groundwater and surface water to evaluate effectiveness of groundwater management activities.

Although California law does not require local agencies to adopt or implement groundwater management plans (GWMPs) or groundwater management programs, incentives exist to encourage local agencies to adopt and implement a GWMP that promotes effective groundwater management. Section 10750 et seq. of the California Water Code requires that six specific components be included in a GWMP for an agency to be eligible for State funding administered by DWR for groundwater projects. The required components include BMOs, agency cooperation, mapping recharge areas, monitoring protocols, and appropriate use of geologic and hydrologic principles for areas outside of alluvial basins.

As part of the draft Bulletin 160 *California Water Plan Update 2013*, DWR reviewed 119 GWMPs (those available as of August 2012) and determined which plans were completed in accordance with the California Water Code as of 2002 [enactment of Senate Bill (SB) 1938]. SB 1938 required that a GWMP have components relating to 1) the monitoring and management of groundwater levels within the basin, 2) groundwater quality degradation, 3) inelastic land subsidence, and 4) changes of surface flow and water quality that directly affect groundwater levels or quality, or are caused by groundwater pumping in the basin.

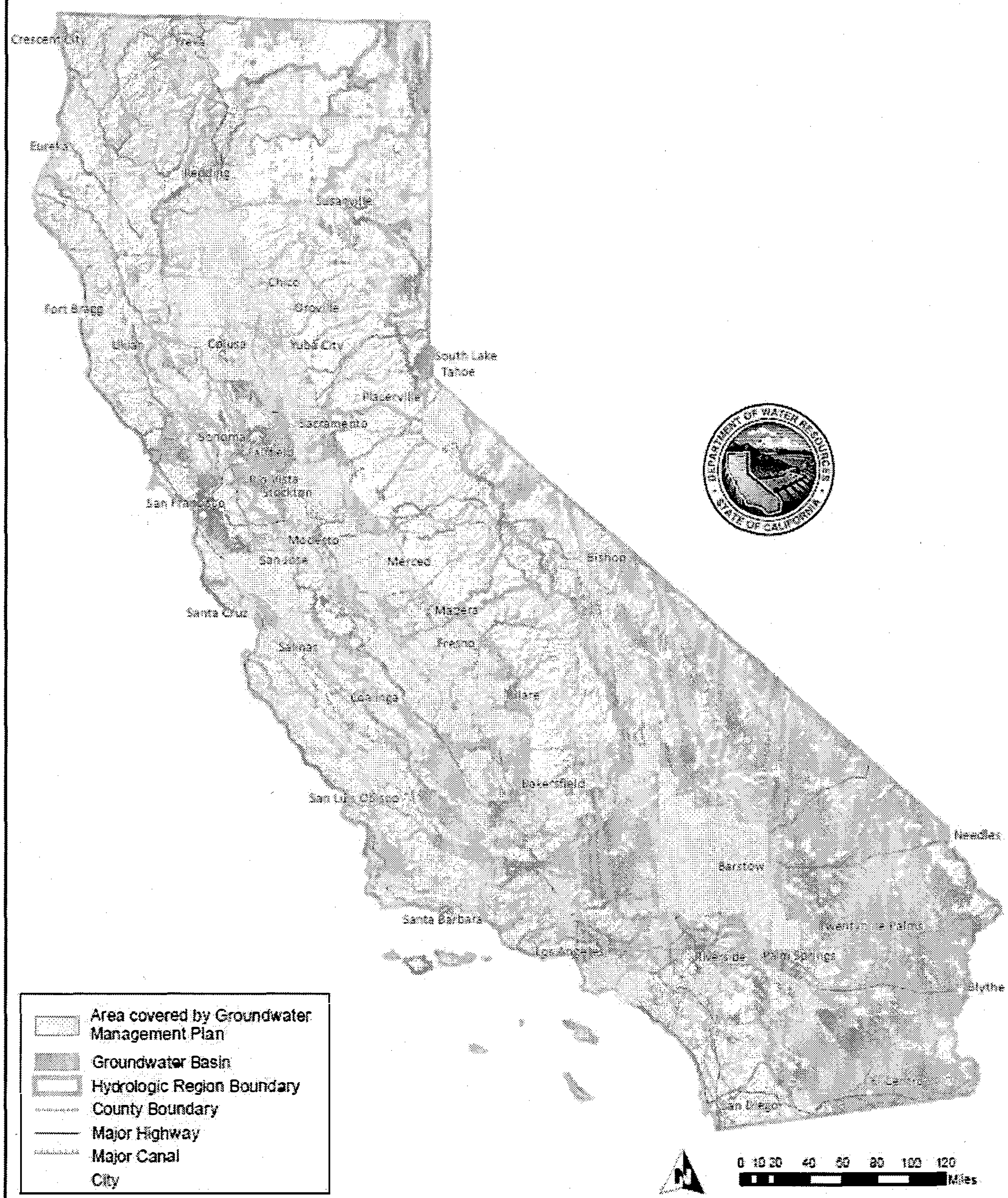
Of the 119 GWMPs, 83 were determined to meet the California Water Code requirements implemented as a result of SB 1938 in 2002. DWR also performed a detailed review of these 83 plans to assess their adherence to the required monitoring and management components. Out of the 83 plans, approximately 90 percent are implementing basin monitoring objectives and protocols for monitoring groundwater levels and groundwater water quality. About 75 percent of the plans have implemented or have provisions to implement monitoring for inelastic land subsidence. Only about 50 percent of the plans address surface water and groundwater interactions. In terms of groundwater management coverage area, about 42 percent of alluvial groundwater basins are encompassed by a GWMP. Also, about 32 percent of alluvial groundwater basins are encompassed by a GWMP determined to address water code requirements pursuant to SB 1938.

GWMPs continue to be developed and updated by the local implementing agencies. For example, plans developed prior to SB 1938 may adopt the provisions of SB 1938 and possibly the more recent additions to the California Water Code in 2012 [enactment of Assembly Bill (AB) 359] concerning groundwater recharge mapping to meet the current requirements. Typical reasons for updating plans are due to changes in basin conditions, changes in legislation, changes in water supply profiles, or increased understanding of the hydrogeology. As of March 20, 2014, the number of GWMPs available to DWR has increased from 119 to 130. A detailed review or analysis of the 11 additional plans has not been conducted. Currently, DWR does not have specific statutory direction regarding any further evaluation of GWMPs.

Figure 27 depicts the GWMP areas throughout California as of October 2013. The GWMP areas are represented as those that were implemented prior to SB 1938, those implemented after SB 1938, and those that also include groundwater recharge mapping pursuant to AB 359.

With respect to GWMPs, several areas of the state either lack a plan, or the existing plan has not been updated to address the requirements of SB 1938. In most cases, plans do not meet the groundwater recharge mapping requirements of AB 359. Reasons vary, but generally it is lack of funding or technical resources to create new or updated GWMPs to meet the necessary elements required by the California Water Code. As a result, such areas may also lack sufficient monitoring and/or management of groundwater and are potentially subject to increased stress or impacts due to drought conditions. For detailed information regarding GWMPs in California, please visit DWRs Groundwater Information Center at www.water.ca.gov/groundwater.

Figure 27 - Groundwater Management Plans



GWMP areas throughout California as of October 2013. The GWMP areas are represented as those that were implemented prior to SB 1938, those implemented after SB 1938, and those that also include groundwater recharge mapping pursuant to AB 359. Document Name: Statewide_GWMP_20140423 Updated: 04/24/2014 Data subject to change without notice.

6.0 CONCLUSION

Groundwater can serve as the primary supply, and in some cases the only option, to meet water demands in many areas of the state. Draft CASGEM basin prioritization results found that the 126 highest-priority basins (High and Medium) account for close to 90 percent of California's annual groundwater use and about 90 percent of the population overlying the groundwater basins. There are 36 alluvial basins that are highly reliant on groundwater and possess the potential for water shortages due to the stress of drought conditions. These 36 basins account for a total of about 2.54 million acres of land and a population of approximately 6.18 million. Based on the available groundwater level data, there are several areas of the state with recent groundwater levels at all-time historical lows. Groundwater levels throughout the state have generally declined since spring 2013, and more notably compared to levels observed during the last normal water year of 2010. Many basins and counties have experienced significant water well deepening activities since 2010—an activity indicative of declining groundwater levels. Key hydrographs for selected wells throughout the state provide a longer term analysis of water level trends in conjunction with recent declines caused by drought conditions.

Statewide, there are 4,122 CASGEM wells and 39,429 Voluntary wells represented in the WDL groundwater level database. Although there is a fairly robust network of monitoring wells available to assess groundwater conditions, gaps in groundwater monitoring persist. There are 40 High and Medium priority alluvial groundwater basins that are currently not monitored under the CASGEM Program, and another 13 basins that are only partially monitored. Based on monitoring data within the WDL database for 2013, there are notable gaps in groundwater level data for the San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions. With respect to groundwater management planning, several areas of the state either lack a GWMP, or the existing plan has not been updated to address the requirements of the California Water Code as of 2002 (SB 1938) or 2012 (AB 359). Although a local agency may have an adopted GWMP, many areas do not have controls in place to restrict or stop groundwater pumping. Groundwater pumping is expected to increase as drought conditions worsen. The increased pumping can lead to adverse or severe conditions including dry wells, land subsidence, decreased water quality, saline intrusion, and stream depletion.

This Update can also serve as an indicator that additional groundwater information is needed to adequately address groundwater issues in the state. DWR is making progress to fulfill the objectives and actions included in the Governor's California Water Action Plan, and to implement the next phase of the CASGEM Program. DWR promotes sustainable groundwater management at the local and regional level through technical guidance, financial assistance, interagency coordination, groundwater monitoring, basin assessments, and advancement of integrated regional water management. For detailed information regarding groundwater and groundwater management in California, please visit DWR's Groundwater Information Center at www.water.ca.gov/groundwater. For more information regarding DWR's drought response efforts, please visit www.water.ca.gov/waterconditions.